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GENTLEMEN EMINENT IN SCIENCE AND LITERATURE.

IN EIGHTEEN VOLUMES.

VOLUME IX.

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THE

EDINBURGH ENCYCLOPÆDIA.

ENGLAND.

PART II. STATISTICS.—CONTINUED.

CHAP. IX.

Manufactures.—Continued.

SECT. III.—*Manufactures of Silk, Linen, Stockings, Leather, Iron, Steel, Copper, Brass, Toys, &c.; Earthen and China Ware, Glass, Paper, Hats, &c.; Variety of Manufactures concentrated in single Towns, as in Bristol, &c.*

Historical notices.

ALTHOUGH the silk manufacture is of considerable antiquity in England, yet it has never flourished to any great extent; and at present is of very inconsiderable importance and value. It appears, that about the middle of the 13th century, a very large quantity of silk goods, (at that time a rarity in almost every part of Europe), was brought into this country. The novelty and splendour of this article of dress seems to have excited general interest among our nobility; but it was not till nearly two centuries afterwards, that the silk manufacture was introduced. Between the years 1455 and 1463, the women in many parts of England were engaged in it; and in order to encourage their labours, the importation of several articles of foreign silk was prohibited: this prohibition was reinforced under severe penalties, about 20 years afterwards; but it seems not to have been effectual, as foreign silk goods were not only much better, but much cheaper, than any that could be made here. About the beginning of the 17th century, the manufacture of broad silk was introduced; King James having previously in vain attempted to introduce silk worms into this country. In 1629, the silk throwers in London were incorporated; and this branch of the trade seems to have flourished so well, that about 30 years afterwards their numbers in the metropolis amounted to 40,000. So far back as the year 1558, the Russia company had imported raw silk probably the produce of China, procured through Russia; but the quantity was very inconsiderable; and the silk trade was much impeded and cramped by the difficulty of procuring it from other places. This obstruction continued till the year 1681, when, in consequence of the importation of raw silk from India, it is stated that the English silk manufacture was quadrupled. Within four years after this, the French refugees came over, and were established in Spittalfields, and at Canterbury, and other places. From 1686 to 1688, the average annual importation of silk imported from France, amounted to upwards of L.700,000. The year 1719 forms a remarkable epoch in the history of the silk trade in England; a patent having been granted at this time for the famous machine for throwing silk, erected by Sir Thomas Lombe and his brother, made from a model they had clandestinely obtained from Italy. By means of this machine, it was confidently expected that the manufacture of silk would be much extended, being no longer dependent on foreign countries for a supply of the prepared material. The silk manufacture was indeed extended, but it appears that the importation of Italian organized silk was indispensibly necessary for the warp in the manufacture. An act of Parliament was therefore passed in the year 1779, to permit the importation of it in the most free and unrestricted manner; and this act was reinforced in 1783. The silk trade of this country may justly be deemed to have been at its acme about this period, since very shortly afterwards cotton, in a great measure, superseded silk for ladies gowns. In 1783, an estimate (to which we have already referred), was published of the annual produce and condition of the principal manufactures in this kingdom; according to which, the silk manufacture was rated at L. 3,350,000: most probably an overcharged estimate. It is curious to observe the estimate which this author puts on the value of the cotton trade at this time—only L.960,000: How

French refugees.

1783.

1793.

different are the two manufactures at present! So rapid and general was the change of fashion, which substituted cotton for silk, that in the year 1793, in the neighbourhood of Spittalfields alone, 4500 looms were shut up: these looms, when in full work, gave employment to 10,000 people, of whom more than a half were women and children. A short time before this, the East India Company, in order to encourage the British manufacture of silk, introduced into Bengal the Italian method of winding it; and they were able to render this country in a great measure independent of Italy, &c. for raw and thrown silk; besides, it was ascertained, that the throw mills in England, on the whole, threw only about 50,000 pounds of silk in the year, which was not equal to an eighth part of the thrown silk imported. But, unfortunately, the revolution in fashion took place just about the time when the East India Company had matured their plans.

State at present.

The following is the state of the silk manufacture of this country at present, in the principal places where it is carried on:—At Derby, there are 12 twist mills, on the model of those brought over by Sir Thomas Lombe, which give employment to about 1000 people, mostly women and children. At Macclesfield, between 20 and 30 silk mills are generally at work for the throwing of silk, and making of sewing silk, most of which are turned by water; waste silk is also spun for the making of stockings and silk handkerchiefs, ribbons, tape, &c. manufactured. At Leek, ribbons, sewing silk, silk twist, and buttons: this place and Coventry have taken away a considerable part of the silk trade from Spittalfields, in consequence, it is supposed, of the effects of the act of Parliament for regulating wages at the latter place. Coventry and Atherstone in the same county, are the principal places for the manufacture of ribbons. At St Albans and Watford, in Hertfordshire, there are silk mills on a new and improved construction, which give employment to a considerable number of people. There are likewise silk mills at Sheffield; Bruton, in Somersetshire; Sherbourne and Stalbridge in Dorsetshire; Nottingham, Chesterfield, Congleton, where silk is spun for the ribbon manufacture at Coventry, and several other places. Silk goods, of various descriptions, are manufactured at Oakingham and Colchester; silk handkerchiefs at Manchester, &c.; and at Towcester in Northamptonshire, the chief manufacture is silk wrought by machinery. We have already mentioned, that part of the Spittalfields manufactures have been transferred to Coventry and Leek, in consequence of the act for regulating wages: this act has also induced some master manufacturers of gauze, who used to make that article in Spittalfields, to remove their trade to Reading, in Berkshire, where it is rather in a flourishing state. Spittalfields, however, must still be regarded as the principal seat of the silk trade of this country: in that district, there are upwards of 20,000 looms employed, principally in the manufacture of light silks, which are exported to America when the trade is open. As there is less of the raw material in them, the English silk manufacturer can compete, in the American market, with the French manufacturer; but it is otherwise with heavy silks, in which the proportion of the raw material is greater. Besides America, the West Indies take off a considerable part of their goods; and it is calculated that one third are used for home consumption. The slight articles are made almost entirely by women and children. There are three persons to two looms, besides windsters and warpers; from this, and from the circumstance mentioned before, that when the trade was so bad in the year 1793, that 4500 looms were shut up, 10,000 people were thrown out of employ, we may safely reckon the total number of people employed in the silk manufacture in Spittalfields at between 25,000 and 30,000.

Mr Grellier's statement.

Mr Grellier has attempted to estimate the value of this manufacture in the following manner: "The average quantity of raw and thrown silk imported in three years preceding the 5th of January 1797, was 883,438 lb. the value of which when manufactured is about L. 2,700,000. The cost of silk to the manufacturer, if raw and thrown are taken together at only 28s. per pound, amounts to L. 1,260,000; and the profits of the manufacturer L. 245,454, at the rate of 10 per cent. on the cost when manufactured." He adds, that the number of persons employed in this manufacture has been stated at 200,000, but there appears no reason to believe that it exceeds 65,000 of all descriptions. This estimate seems to be manifestly wrong in one important particular. Mr Grellier takes the profit of the manufacturer at the rate of 10 per cent on the cost of the article when manufactured; but the value according to him is L. 2,700,000: ten per cent. on this is evidently L. 270,000, and not L. 245,454. The imports of silk from Italy in 20 years, from 1781 to 1800 inclusive, were on the average per annum about 4200 bales. The imports from 1800 to 1805 were rather greater, amounting to 672,409 pounds. The average annual imports of silk from Bengal, from 1775 to 1794, amounted to 3240 bales; and from 1795 to 1804, the average import from Bengal was about 2128 bales. From this it will appear, that the annual consumption of silk is about 6328 bales, or nearly 950,000 pounds. Assuming the price to be 30s. per pound, the value of the raw material will be L. 1,425,000; and supposing that the average increased value of all silk goods when manufactured is three times that of the raw material, the value of the whole silk manufactured will be L. 4,275,000; deducting from this the sum of L. 1,425,000, it will give us L. 3,250,000 as the sum out of which the interest of capital, manufacturing profit, and labourers wages are to be taken. If we reckon 20 per cent. on this sum for the two former, it will give 641,000, and the remainder, L. 2,609,000, will be the amount of the labourers wages. As a very large proportion of these live in London, we cannot reckon their wages on an average of town and country, and men, women, and children, at less than 15s. a week, or about L. 40 a year. If, therefore, we divide the sum of L. 2,609,000 by 40, we shall probably come near the number of people employed in this manufacture: this will give us 65,250, and this number of people seems much more probable than the number stated by Mr Grellier, when we consider that in Spittalfields there are about 25,000 or 30,000, and that in Coventry the ribbon trade occupies a considerable proportion of the inhabitants.

Probable value, &c.

Linen manufacture.

The linen manufacture of England is one of very small importance, though formerly it appears to have been of greater extent and value. This article was made in this country so early as the year 1189, but at that time by far the greatest quantity used, as well as that of the finest quality, was imported from Flanders. About the middle of the 16th century, Norfolk engaged in this manufacture, and a particular privilege was granted to this county, of manufacturing a kind then called Dorneck in it. About a century afterwards, Irish linen yarn was much imported, and manufactured into linen in Manchester; and it is rather singular, that notwithstanding the almost overwhelming influ-

Historical notices.

ence of the cotton trade, this manufacture still keeps its ground in Lancashire nearly to as great an extent as in any other district of England. Towards the end of the seventeenth century, our importations of linen from France were very large. Mr King, in his *British Merchant*, rates them at the annual value of L.900,000; at the same time he gives rather a favourable view of the increase of this manufacture in England. In Lancashire and Cheshire alone, he says there was an increase to the amount of L.240,000 per annum; and that in these counties there were 10,000 looms, and 60,000 people wholly employed and subsisted by that manufacture. The increase in Dorsetshire and Somersethire (where this manufacture still subsists) he estimates at L.100,000, and in the other English counties at L.40,000. The importation of linen appears at this time (1702) to have been recent; for he reckons the whole amount of it L.80,000 under the head of increase. Besides linen of our own manufacture, we procured it from Scotland to the amount of L.100,000, from Holland to the amount of upwards of L.200,000, and from Germany to the amount of upwards of half a million. The annual consumption of linen he rates at L.1,750,000, of which he says that the English manufacturer supplied L.746,561, 0s. 1d. Such, according to him, was the state of this manufacture in England at the beginning of the eighteenth century. Parliament seems to have been early anxious to encourage and extend this manufacture. By the act of tonnage and poundage, passed in the 12th of Charles II. duties were imposed on foreign linens; but in consequence of their not being duly proportioned and levied, and of the decrease in the value of the money duty, as well as the improvements in the fabric of German linens, they were not so beneficial as was expected and intended. In the year 1743, a bounty was first granted on the exportation of British linens; and in 1745, this bounty was augmented. It appears by the custom-house books, that, prior to the year 1746, British linen was so small an article of export trade, that the whole quantity exported from England never amounted in any one year to 200,000 yards; and it may be remarked, as forming a striking contrast between the state of this manufacture in England and Scotland at that time and at this, that the whole export from the latter country did not reach 90,000 yards. The increase of the manufacture in England will appear from the following facts. In the year 1743, the year when the bounty took place, the quantity exported from England drawing bounty was 52,779 yards; in 1753, 641,510 yards; in 1763, 2,308,310 yards; in 1773, 5,868,238 yards; and in 1783, 8,867,915 yards. On an average of 10 years, from the 5th January 1776 to the 5th January 1786, the linen drawing bounty exported from England was 5,315,354 yards; and the total average quantity of what was exported and what was consumed in England, was in 1786 to be 30,000.000 yards, in value nearly L.1,600,000 per annum, and employing and supporting about 200,000 people. It ought also to be remarked, that the increase in the exportation of the finer linens not entitled to bounty, between 1743 and 1783, was nearly as great in value, though not in quantity.

Effect of bounty on it.

Irish linen imported.

Yet notwithstanding this increase in the linen manufacture of England, the importation of linen from Ireland continued to increase; and it is worthy of remark, that at this period, from a comparison of the English imports and exports of Irish linen, it appears that four-fifths, or perhaps seven-eighths of the whole, were consumed by the people of England, and those mostly of the finest quality. The Lords of Trade, in investigating this subject, reckoned the home consumption as at least four-fifths; but while the importation from Ireland increased, that from foreign countries diminished, as will appear from the following statement:

Imported.		Exported.
18,584,503 ells	in 1743 . . .	9,894,837 ells
8,954,649	. . . 1773 . . .	4,385,276
9,629,854	decrease	5,509,561

This manufacture, as well as that of silk, suffered from the rivalship of the cotton manufacture about the year 1790, but not nearly to so great a degree. There are very few data respecting this manufacture about this period. It appears, however, that the quantity of linens printed in England and Wales in the year 1796, was considerably less than the quantity printed in 1800, though the exact difference cannot be stated, as the returns laid before parliament did not distinguish between printed linens and stuffs. Besides the substitution of printed cottons for printed linens in dress, the latter trade must have suffered by the very general adoption of cotton stockings instead of thread ones, while the great increase in the importation of Irish linens must have discouraged another branch of the trade.

Present state.

That the principal branch of the linen manufacture must at this time be at a low ebb in England, will appear from the following facts, ascertained from official documents: On an average from the union with Ireland to the 5th of January 1813, there have been annually retained, for home consumption in this country, 32,758,958 yards of Irish linen. The annual average quantity of plain linen imported from Germany, and retained for home consumption, between 1801 and 1812, was upwards of two million yards; from Russia nearly the same quantity; from Holland and France very trifling. Although not immediately connected with this part of the linen trade, we may add from the same documents, that, from 1801 to 1813, the annual average quantity of Hessen's canvass retained for home consumption, was upwards of 700,000 yards; of packing upwards of 300,000 yards; of damask and diaper of Silesia, between 60,000 and 70,000 yards; of cambric and French lawns upwards of 17,000 whole pieces. All the Silesia lawns were exported again. Of sail cloth, upwards of 47,000 ells were retained for home consumption; and of chequered and striped linen upwards of 12,000 ells. The average total of all sorts retained for home consumption during this period, was 14,559 pieces, 5,836,621 ells, and 64,706 yards. Although this statement includes Scotland, yet as little foreign linen (except Irish) is used there, it may be taken as a sufficiently accurate statement of the consumption of foreign articles made of flax and hemp in England; and in conjunction with the statement of the average quantity of Irish linen retained, it at least serves to prove, that the linen manufacture in England cannot be of much importance or value. It may, however, be proper to point out the principal places in this country, where articles are manufactured from flax or hemp.

Canvass for sailcloth is manufactured at Warrington, though not nearly to so great an extent as formerly, as at one time it was calculated that half of the heavy sailcloth used in the navy was manufactured here; at Kirkham, in the Filde district of Lancashire, where a large quantity is made for the navy, 6000 bolts of canvass having been supplied by two houses in the space of six months; at Lancaster, Whitehaven, Workington, Stockton, Whitby, Hull, Retford in Nottinghamshire, Reading, Oxford, Bridport, and all the district between that and Beaminster in Dorsetshire, as well as in the adjoining part of Somersetshire. At Bridport, there is also an extensive manufacture of nets of all sorts, lines, and small cordage. At one period during the late war, the number of contractors for sailcloth for the navy were in England 23, each having 20 looms, and each loom producing two pieces of canvass in the week; but England was so little able to supply the demand, that by far the largest proportion was obtained from Scotland, where the sailcloth manufactures were increasing, while those in England were diminishing.

In Suffolk, a considerable quantity of hemp is grown, which is manufactured into strong and coarse linen, and also into sacking and cordage. The latter are made chiefly in the vicinity of Stowmarket. Linen for sheeting is made at Bromsgrove in Worcestershire; and sacking for hops, &c. is manufactured in Berkshire, where 4000 people are employed, principally at Abingdon, and in most of the hop counties. These, with some other linen manufactures in different parts of Westmoreland, Lancashire, Dorsetshire, Durham, &c. of very inconsiderable extent or importance, may be considered as the principal in England. Linen thread is made in considerable quantity, by the poor people in cottages, in the neighbourhood of Workington, and exchanged with trades people for goods. Mills for spinning flax were first invented at Darlington, where they are still used. At this place, there is also a manufacture of huckabacks, diapers, and sheeting. It will be evident from this account of them, that, with the exception of the sailcloth manufacture, the value of the goods made, and consequently the value of the raw material, and the amount of the manufacturer's profit, and the workmen's wages, must be very trifling; and as in time of peace this principal branch must necessarily fall off very much, there seems no necessity, even if there were data, to endeavour to ascertain these particulars. It may, however, just be mentioned, that, in the opinion of Mr Grellier, the linen trade of England amounts to about one million annually.

Stocking manufacture,

As stockings are made of worsted, silk, and cotton, we shall consider the manufacture of them in this place. The art of knitting stockings was introduced about the middle of the 16th century; and within 27 years after needles had been applied to this purpose, the steel frame was invented, or introduced by one Lee of Calverton, in Nottinghamshire. This county, and the adjoining counties of Derby and Leicester, still continue the seat of the stocking manufacture. The Frame-work Knitters Company were incorporated in 1664; but during the first century after the invention, few improvements were made in the frames, as in 1660 two men were employed to work one frame. Latterly, however, great improvements have taken place in this machine, and it has been applied to various purposes besides the making of stockings.

in Leicestershire,

The species of stockings made at present in Leicestershire, Nottinghamshire, and Derbyshire, in some respects vary from one another. In the first mentioned county, the stockings are principally or wholly of worsted or of cotton; very few, if any, silk stockings being made in the county. The worsted and cotton for manufacturing them, is prepared either in the county, or in the neighbouring county of Warwick, particularly in Warwick itself, where one house is very extensively concerned in this trade. The articles made in Leicestershire are principally light, consisting of sandals, gloves, half stockings, &c. a great many of which were formerly exported to America. The chief places in the county where this trade is carried on, are Leicester, Hinckley, and Loughborough; but in all the principal villages through most parts of Leicestershire, the inhabitants are more or less engaged in this trade. It is calculated, that there are employed about 20,000 people. In Hinckley alone, 3000 are generally employed. The whole hosiery annually made is estimated at the value of L.1,500,000.

in Nottinghamshire.

In Nottinghamshire, the stocking-trade is still more extensive, as well as valuable, than in Leicestershire. Besides stockings, stocking-pieces for pantaloons, &c. are made; and of stockings themselves a great proportion are silk. Thread stockings were formerly made here in great quantities, but, as we before mentioned, since the advancement of the cotton trade, they have been entirely superseded by cotton stockings. The trade of Nottinghamshire has undergone great fluctuations, and is by no means at present in a settled state. In the year 1807, which was a flourishing year, it was very great in all its branches. Besides stockings and stocking-pieces, cotton caps have been made in this county for some years. These are exported in great quantities to the Mediterranean, 60,000 dozen having been sent in one year. Formerly the counties bordering on this sea, were supplied from Germany; but the manufacturers of Nottinghamshire gained possession of the market, by superior industry and attention, and smaller profits. Pieces are also made in the frame, which are afterwards cut up into gloves, and exported to the United States and Canada. All kinds of fleecy hosiery are likewise made; but what principally distinguishes Nottinghamshire, is its manufacture of lace on the stocking-frame. Warp lace was invented in 1804; and, in the year 1805, cotton-yarn (for this lace is made of cotton) was wrought fine enough to be made into double press lace, and so much approved, that in 1807 there were 1200 frames employed; and in 1808, 1500. About this time an inferior kind of lace was made; and it is said that the decaying and unsettled state of the Nottinghamshire manufacture is, in a great measure, owing to the bad quality of these goods. Within these few years, a patent has been obtained for net silk lace, for ladies' veils, &c. in the making of which a great many women are employed, chiefly at Castle Donnington and its neighbourhood, in Leicestershire, dependant on Nottingham.

in Derbyshire.

The hosiery manufacture of Derbyshire is chiefly confined to those parts of the county that border on Nottinghamshire, and to Litton, near Tideswell. The number of frames employed, including those on which silk and cotton stockings are wrought, has been calculated about 1350. In all these counties, a large proportion of the manufacturers are men of small capital. Large quantities of cotton gloves are made in Leicestershire and Nottinghamshire: woollen gloves are principally made in Wales and the north of England.

Knit stockings.

Knit stockings are now seldom made; though, in the more hilly or retired parts of England, especially in Richmondshire, in the North Riding of Yorkshire, in Cumberland, and in the isle of Purbeck, and at Wimborne in Dorsetshire, considerable quantities are made.

Lace.

Linen-lace, made by bobbins, is the chief employment of the women in the small towns of Buckinghamshire, Bedfordshire, Oxfordshire, Northamptonshire, and in some parts of Devonshire. It is supposed that more lace of this kind is made at Newport Pagnell, in the first mentioned county, than in all the rest of

England. At Honiton, in Devonshire, the broadest lace is made; but, since the introduction of the Nottinghamshire cotton lace, that made of linen thread has fallen much into disuse; nor is the decline of the trade to be lamented, since, from the sedentary habits which were necessary to carry it on, and from the practice of the females who were engaged in it, crowding together in small, ill ventilated rooms, in the winter time, for the purpose of keeping themselves warm, it produced much ill health in the districts in which it was the chief occupation.

Shirt buttons.

As somewhat connected with this subject, we may mention the manufacture of shirt-buttons. This trifling article is made to a considerable amount, in many towns in Dorsetshire, particularly about Blandford and Shaftesbury; and a practice prevails here, which we have already noticed as prevailing with respect to the making of linen thread at Workington. The shirt-buttons are generally exchanged for goods to the tradesmen, who in their turn endeavour to force them off, in exchange for what commodities they may want. This practice of paying for one species of manufacture by another, or rather of compelling the labouring manufacturer to take goods in exchange for his work, seems to have prevailed at an early period; since a law was passed against it in the time of Edward IV. and another law in the time of George II.: but the practice still prevails, as we have seen in Dorsetshire; and, when trade is bad in Nottinghamshire, it is resorted to.

Curious instance of division of labour.

As the manufactures of wool, cotton, silk, and linen, may be regarded as intimately connected, both with respect to the mode in which they are for the most part carried on, and the purposes to which the goods they produce are applied, we shall subjoin to this account of them a curious and striking instance of the division of labour, as related to them, before we proceed to the other species of manufactures in this kingdom. In most places where woollen, cotton, or linen goods are made to any great extent, there are a set of men who are denominated fine-drawers: the business of these men is to examine the goods, and if they find any rent or blemish, to mend it in such a manner that it either may not be perceived, or at least may not injure the sale of the goods. But besides these fine-drawers, there are in London a set of men denominated packers. Men of the same denomination are found in all the large manufacturing towns; but a packer, in the London acceptation of the term, is almost, if not entirely, confined to the metropolis. His business consists in this:—When a merchant receives orders from abroad for superfine cloths, kerseymeres, &c. or cotton or linen goods, he applies to the packer, who, from his experience, knows exactly the kind of goods which are wanted, and where they are to be procured. The packer takes the orders to the factors, and purchases from them what he deems necessary and proper: but as many of these goods are sold in an unfinished state, undyed, and perhaps unscoured, the packer sees to the scouring, dyeing, pressing, dressing, &c. Even after this, his labour and more peculiar business only commences; for he has to ornament and decorate them according to the market for which they are wanted; since, if goods were taken out to the East Indies, for example, without the appropriate ornaments, the natives would not believe that they were of British manufacture, and would consequently refuse to purchase them. The packer employs the fine-drawer under him, to examine if there be any flaws, and fine-draw them.

Leather manufacture.

The leather trade of England is one of considerable extent and importance; but there are no materials which can supply even a sketch of its history. In the political essays concerning the British empire, published in the year 1772, by J. Campbell, (though without his name), he gives the following estimate of the value of this manufacture in Great Britain. Although it comprehends Scotland, and it does not appear on what data it is grounded, yet, as this author seems to be accurate and well informed on other points respecting the state of our manufactures at this period, we shall, in the absence of more satisfactory statements, subjoin it. "Supposing that there are nine millions of people in Great Britain and Ireland, and that three-fourths of them wear leather shoes, (which cannot be beyond the reality), each person upon a medium five pairs in a year, and the price, on a medium, 6s. a pair, (boots included), this consumption amounts to

	L.10,125,000
Supposing the consumption of leather by coaches, chaises, &c. - - - -	100,000
By harness, saddles, and bridles - -	500,000
By leather breeches, suppose 200,000 pair to be worn annually, at 10s. on an average - - - - - -	1,000,000
Total	L.11,725,000

The reader will not fail to remark the large sum allowed for leather breeches, an article now seldom met with among the lower classes, (with whom it was then very general,) and not very much worn by any rank. Of this calculation it may be remarked, that it estimates the population of Great Britain and Ireland too low, but probably it does not carry the value of the leather manufacture (if we suppose the calculation to apply only to Great Britain, and the population of it, independently of Ireland, to have been 9,000,000,) much too high. In the year 1783, according to the estimate of the annual produce and condition of the principal manufactures in Great Britain at that time, already referred to, the annual produce of leather was stated at L.10,500,000; and it was said to be in a declining state.

About two years ago, in consequence of an intention on the part of government to lay a tax upon leather, most of the principal people connected with the different branches of the trade were examined before a Committee of the House of Commons. The information on the state of this manufacture, connected with our subject, which they gave, we shall lay before our readers, along with information on other points on which they were not called upon to give their evidence. The first point relates to the supply of the raw material. This of course we get in large quantities at home; though the foreign hides are estimated at three-sevenths of the whole quantity used; and of the skins of calves, sheep, and deer, one half.

The importation of raw hides appears to have been most considerable from the continent of Europe, till the year 1807, when it fell off nearly one-half. In 1808 and 1809, it was not one-tenth of what it had been prior to 1807; in 1810 it rose higher than in any preceding year, (from 1803) except 1805; in 1811 and 1812, it again fell very low, not amounting on the average of these two years, to one-tenth of the importation of 1807. From 1803 to 1807, the importation of hides from America was next in amount to the importation from Europe; but in 1808, the importation from America was tripled; and in 1811 it was again tripled. For some time after we began to trade with Buenos Ayres, hides were the principal remittance in return for the goods sent out. The importation of raw hides from Ireland and the West Indies has continued nearly stationary. With respect to the importation of tanned hides, skins, and leather, it takes place chiefly from Ireland, from the continent of Europe in time of peace, and sometimes from the East Indies.

Leather tanned annually.

According to the opinion of the leather manufacturers, examined before the Committee, the leather tanned within the limits of the chief office in London, bears about the proportion of one to eight of all the leather tanned in England and Wales. Proceeding on this supposition, we have, from the return of leather tanned within the limits of the chief office between the 5th January 1812 and 5th January 1813, calculated the quantity of all the leather tanned within that time in England and Wales, as follows.

			lbs.
Hides tanned in England and Wales, number	8,851,352	weight	39,829,080
Goat's skins tanned in do.	363,324	dozen.	
Roans tanned in do. -	273,800	do.	
Pieces of goat and deer skins	396,836	weight	334,744

Tanneries.

In almost every part of England and Wales there are tanneries; but they are most numerous and extensive in Cumberland, Westmoreland, Lancashire, Cheshire, particularly the middle part of the county, Shropshire, Sussex, Berkshire, (at Wantage in this county is one of the largest in the kingdom,) Lincolnshire, and Northumberland. About Louth, in Lincolnshire, large sheep skins, called Lincolnshire basils, are tanned, which are used for blacksmiths aprons. But by far the greatest tanneries are in Bermondsey, in the Borough. The manufacture of what is called Morocco leather is almost entirely confined to this place. The goat's skins used for this purpose are chiefly got from Mogadore, in Morocco; some also come from Germany, but they are of an inferior quality. The capital necessary for the tanning business is very considerable, since, besides what is laid out in buildings, &c. there must be sufficient to wait the returns, which are necessarily very slow. It is calculated that the capital employed, taking in buildings, pits, hides, bark, &c. is more than double the annual sale. The tanners complain that it requires a greater weight of hide to make a pound of leather now than formerly; and this they ascribe to the rapid manner in which cattle are fattened.

Shoes.

The principal leather manufacture, is, of course, that of shoes, either for home consumption, or for exportation; and the counties in which shoes are made, on the largest scale, are Northamptonshire and Staffordshire. In the former county, Northampton, and more particularly Wellingborough and Kettering; in Staffordshire, the county town and Newcastle-under-Lyne are the principal manufacturing places; in most of which, the leather is delivered out by the master manufacturers to the small makers. Shoes are also made at Nantwich, Congleton, and Sandbach in Cheshire, by the small makers, and sent to the London ware-houses. While the war lasted, the demand for shoes for the army was very great; the contractor generally supplying upwards of 600,000 pair annually; these he procured almost entirely from Northamptonshire and Staffordshire. In Stafford there was one house which employed 1000 workmen, and made about L.75,000 worth in the course of the year. In this manufacture, a considerable number of women and children were employed; and it may be remarked, that during the war a number of people in Norwich and other places found employment by sewing soles to the list shoes made by the French prisoners. Leather slippers are made in great quantities at Bicester in Oxfordshire.

It is impossible to conjecture the probable quantity of leather used in various ways for home consumption in this country: perhaps the following facts may throw some light on this subject. The probable annual consumption of leather for one pair of a gentleman's coach harness, is about 10 pounds; for a common riding saddle and bridle, about 3lbs.; for cart harness, about the same quantity; for boots, 16lbs.; for walking shoes, 7lbs.; for dress shoes, 8½lbs.; for high-laced shoes, 7½lbs.; and for soldiers shoes, 8½lbs.

Shoes are principally exported to the East Indies, Batavia, the West Indies, and Canada; while we traded with the United States, a great quantity of women's shoes were sent thither, and many females were employed in binding them.

Saddles.

Saddles are made in almost every town, but Sherborne and Lyn are particularly remarkable for this manufacture; they are made here, as well as in London, for exportation. The hog-skins which, when tanned, are used for the seat of the saddle, are principally imported from Russia. We shall afterwards have occasion to notice this manufacture, when we come to treat of the manufactures in the hardware line about Birmingham.

Gloves.

Gloves are manufactured chiefly at Woodstock, Worcester, where the manufacture is so extensive that it employs nearly 500 women, besides men, and the returns are about L.100,000; Stourbridge, Hereford, York, Swindon in Wiltshire, Yeovil in Somersetshire, Hexham, &c. a number of weakly people and children are employed in this trade; but they are now made by machinery in some places. Chamois leather is dressed by mills at Darlington.

Value of the manufacture.

The amount of the value of this manufacture, in all its branches. it is impossible to ascertain with any degree of accuracy, though it must be very considerable. In the article of shoes alone, the home consumption must be great; if we suppose that it costs each individual only 10s. a year, on an average of all classes and ages, and of both sexes, for shoes, this will bring the amount to above L.5,000,000. The value of all other articles made of leather, such as harness, saddlery, &c. and what is consumed in coaches, must, at least, reach the same sum; so that, on a moderate calculation, the annual value of this manufacture may be rated at L.10,000,000; estimating the value of the raw material at the usual rate, that is, as equal to one third of the value of the manufactured article, this will give us L.3,333,333, leaving L.6,666,667. As in many branches of this manufacture, especially in the most extensive, the shoe trade, there is little outlay of capital, except for the purchase of the raw material, probably 15 per cent. on this sum of L.6,666,667 will be nearly the amount of manufacturing profit; this will be nearly L.1,000,000, and the remainder, divided by L.25, (the probable average amount of the annual wages of the persons who work at this manufacture,) will give us about 227,000 as the number of persons employed in the leather manufacture.

Manufacture of iron.

In treating of the mines of England, we incidentally noticed some of the iron works in which that metal was brought into the state of what is called pig and bar iron, partly because this process could scarcely be called a manufacture, and partly because we wished to form an estimate of the probable produce of the English mines, by ascertaining the quantity of pig and bar iron that was made in the kingdom. But now that we are about to enter on a view of the hardware manufacture, which, in point of extent and importance, is probably next to the woollen and cotton manufactures, and certainly has contributed, along with them, to raise the national character in the estimation of foreigners, very high, on the score of ingenuity and industry; it will be proper to commence this branch of our subject, by a notice of the most important iron founderies.

Perhaps the most extensive are those at Colebrook Dale, in Shropshire, and at Mossbrough, near Rotheram, in Yorkshire, in which iron in all its forms is manufactured, from the ponderous iron bridge to small culinary utensils. At Bersham, near Wrexham, there are not only smelting furnaces, but furnaces for smelting the pig iron, and casting it into various articles, such as cylinders for fire-engines, water pipes, boilers, pots and pans of all sizes, box and flat irons, and cannon and ball of all dimensions. Here also are forges for malleable iron, and wire works, as well as a brass foundery. At Walton, near Chesterfield, there are a furnace and foundery, in which nearly the same articles are manufactured as at the works near Wrexham. There are likewise large iron founderies at Bradford, Burton on Trent, Neath, Merthy Tydvil, Swansea, Tavistock, and many other places, particularly in the counties of Lancashire, on the northern part near Ulverstone, Durham, particularly at Swalwell, Winlaton, Lumley, Shortly Bridge, Derwent Coat, and Blackhall Mills; at the three latter places are manufactories of steel for sword blades;—Gateshead, Chester-le-Street, and Sunderland; Yorkshire, Staffordshire, Shropshire, Derbyshire, and Monmouth. Copper works are established at Swansea, Aberaven, Cobham, (at these two places there are also iron works, indeed they are often united,) Wandsworth, St Helen's, (at which place a very extensive business was carried on, while the Anglesea mines were most productive) likewise in the district of Furness in Lancashire. Great Marlow, where brass and steel thimbles are also made. Holywell, where copper sheets for the bottoms of ships, copper-nails, bolts, brass, brass-wire, and plate brass, are manufactured. Macclesfield, where also copper for sheathing ships is made, and a considerable quantity of brass, brass-wire, brass nails, &c.

But though these and other works of the like nature, especially some of the iron-works, may astonish us by their magnitude, yet, on reflection, they probably will not excite such wonder and admiration, as the manufactures of Birmingham and Sheffield, and the respective neighbourhoods of these towns.

Birmingham.

Although many of the manufactures carried on in Birmingham come under the description of hardware, yet there are also many which cannot be classed under that or any other general head; but perhaps by no means can we give such an adequate idea of the manufactures of this place, as by the following enumeration of them, in which will be seen their curious, minute, and almost endless variety. It is proper to remark, that, in general, each is a separate trade: this circumstance will account, in a great measure, for the exquisite workmanship of many of the Birmingham goods, and the low price of them all. After this enumeration, we shall offer some remarks on particular branches; for to detail particulars, even respecting a few of them, would carry us far beyond our limits.

List of manufactures there.

Files, guns, pocket-books, gilt toys and jewellery, watch chains and keys. gun-lock filer, plated goods, fire-irons, awl blades, brass-founder, saw and edge tools, rim locksmith, lock and latch maker, swords, bits, buttons, snuffers, bone and ivory toys, cut sprigs, die sinker, carriage lamps, harness plater, steel-chains, cast nails, thimbles, braces, cabinet cases, inkstands, ferrules, compasses, ivory combs, gun-polisher, spectacles, steel toys, pearl buttons, stamper and piercer, stirrups, packing-boxes, japan wares, planes, sword hilts, casting pots, spring latchets, gold-hand manufacturer, paper toys, chaser, saddlers brassfounder, round bolt and chaffing dish maker, scale-beam, steel-yard and screw-plate maker, bridle-cutter, brass nails, and curtain-rings, needles, vice-maker, clock dial painter, curry-combs, rule-maker, link-buttons, wire-drawer, scabbards, iron spoons, spade tree maker, fork-maker, looking-glass, toy and army button-maker, paper-box turner, mouse-traps, sand-paper, gun-stocker, parchment-maker, last and boot-tree maker, glass-grinder, anvils, brazier's tools, gun furniture filer, pendant-maker, ring-turner, bellows, gun-finisher, saddle-tree maker, hammers, carpenters and shoemaker's tools, brass cock founder, hand-whip mounter, pearl and hair-worker, coach-harness forger, button-shank maker, patton-tyes, gimblets, tea urns, medals and coins, copying-machines, pneumatic apparatus, ram-road and chain-maker, gun-case maker, smith's bellows pipe-maker, coffin nails, curtain-rings, glass beads, engine-cutter, scale beams, wood-screw maker, bright-engraver, putty-maker and enamel box maker,—horse, dog, and negro collar, fetter, and dog-lock maker,—pencil-case maker, glass-stainer, paper-stainer, bone mould turner, tortoise shell box and tooth-pick case maker, warming-pans, fishing-tackle, cruet-frames, picture-frames, bayonets, malt-mills, hinges, leather and horn powder-flasks, cork-screws, gun-flints, steel keys and combs, glass buttons, bed and coach-screw maker, umbrella furniture maker, paper-mould maker, button solderer, paper spectacle-case maker, tin-nail and rivet maker, burnisher of toys, shagreen and morocco case maker, seal manufacturer, horn-spoons and buttons, tine-maker, ladies' slippers, stirrup-maker, curb-maker, spur and rowel maker, powder flasks, sticks and rods for angling, sleeve buttons, clock hands, brass mouldings, augers, cock-heel maker, candle-moulds, teapots, case-plate maker, filligree-worker, coach-spring manufacturer, watch-key and glass maker, pattern rings, thong-maker, varnish-maker, dog and cart chain-maker, printing presses, pins, buckle-chaser, jacks, military feathers, barometers, morocco decanters and cruet stands, packing needles, horn lanterns, buckle-ring forger, toy-watch-maker, glass eyes for dolls, mortice and rim locksmith, button-card cutter, iron drawer, gridiron and round bolt maker, spades, dials, gilt-ring maker, steel-box, spectacle-case and gun-charger maker, pocket-lock maker, lamp manufacturer, lead-toy, stock-sinker, glass-house mould maker, casting-mould maker, snuff-boxes, &c.

Remarks on them.

Tedious or unnecessary as this list may appear to some, we have deemed it right to insert it; since, though it may not be complete, it will serve to give a striking and curious picture of the wonderful industry and ingenuity of a town, which does not contain 100,000 inhabitants; for the trades which we have enumerated are all carried on in Birmingham alone. No person is unacquainted with some, probably with many, of the articles of Birmingham manufacture; their superior quality and cheapness must have been noticed, as well as their wonderful adaptation to the purposes of almost every art, that the necessities, or comforts, or luxuries of man requires, as well as to the demands of philosophy and science, and the almost infinite caprices of fashion; but perhaps few know that the articles with which they are acquainted, and which they admire, are but a very few of those manufactured in this town, or suspect that the memory, or even the imagination, might be taxed, without being able to recall, or to conjecture, nearly all the articles which the workmen of Birmingham produce. Our woollen and cotton goods are found over most of the continent of Europe; they contribute to the health or the comforts of the inhabitants of America, Asia, and Africa; but the demand for most of them so evidently proceeds from their being articles of necessity, of the best quality, and at the cheapest price, that we are not much surprised at their wide dispersion; but it is very different with many of the articles of Birmingham manufacture, which are mere toys, constructed indeed with most exquisite skill and untired industry; but still mere toys; and yet they are more generally dispersed than any other of our manufactures; so that perhaps it would be impossible to go amongst the most remote, uninformed, and incurious nation of savages, that had ever been visited by Europeans, without discovering some proof of the workmanship of Birmingham.

But we should still form an inadequate idea of this place, and consequently of the state of the manufactures of England, (for when they are the subject, to omit, or partially to notice Birmingham, would be to do great injustice to it,) if we permitted the reader to suppose, from our silence, that all the manufactures carried on here are of the minute kind, which the list that we have given might lead him to suppose. Our object in giving that list, as we have already remarked, was principally to exhibit a picture of the curious, minute, and almost endless variety of the articles which this place produced. But, besides these, all the more ponderous productions of the casting furnace and rolling mill are here seen on the largest scale, and of the most perfect workmanship. We need only mention Messrs Boulton and Watts manufactory at Soho, in which the most stupenduous steam engines that ever lent their aid to the labour of man, as well as an infinite variety of toys, in every species of metal and composition, are made.

Capital.

The capital employed in the manufactures of Birmingham, is not very large. There are, indeed, in its immediate neighbourhood, ten sets of iron works, which are supposed to have cost L. 50,000 each; but in the town itself, most of the manufacturers are men of small capital; some not possessing more than L. 400 or 500; and many not more than L. 2000 or L. 3000, employing from five to thirty hands. The whole amount of capital in Birmingham, (exclusive of the very large works,) is supposed not to exceed half a million.

Mode of conducting.

The work is partly carried on in work-shops, and partly in the houses of the workmen. Women are principally employed in polishing the goods, in the glass-toy branch, and in making of braces. Boys are chiefly employed by the out-workers as apprentices, and receive the first year about one shilling a week, and the last year from five to ten, besides their clothing: but they receive their food at home. The wages of the men varies very much, both as to the particular branches in which they are engaged, and according to the state of trade. In some branches, where very superior skill, and great experience and attention, are requisite, perhaps as great wages are got, as can be obtained by any workmen in London.

Number of people employed.

It is impossible to state the number of men engaged, even in the most considerable of the Birmingham manufactures, or the exact value of the articles manufactured. The population of the town itself, and of the manufacturing district, which extends about 15 miles, is estimated at 400,000; and it is supposed that nearly 100,000 are employed in the production of coals and minerals, and in the rough preparation of iron, for the manufactures of Birmingham. In the brass foundery branch, which is almost confined to the town, about 10,000 men are employed. In the button trade, from 7000 to 10,000. In the making of braces, a manufacture but lately introduced, about 1000. In the jewellery and gilting trade, from 6000 to 7000. In the making of many of the toys, a very small capital is employed, the value of the article consisting almost entirely in the labour employed in manufacturing it; thus a watch-key, which, perhaps, goes through twenty hands, will, after all, sell for 1d. or 1½d. Perhaps the greatest number of hands are engaged in the burnishing line, it being supposed that nearly 20,000 are thus employed. The article of plated saddlery, which is the principal plated article not made generally at Sheffield, as well as at Birmingham, employs a considerable number of persons. Nor must the manufacture of muskets be forgotten, though that now, it is to be hoped, will be almost at an end. In time of war, muskets of the value of L. 400,000 were manufactured in Birmingham. Some years ago, when the trade with America was open, between 200 and 300 tons of steel were annually sent thither from this place. The total value of all the articles made in the town itself, is estimated at L. 2,000,000, of which one half are sold for home consumption. By far the greatest proportion of the other half was sent to the United States when the commercial intercourse was open, and the remainder to South America, Spain, Portugal, Malta, &c.

Japan ware.

Hitherto we have chiefly confined our notices to the manufactures of Birmingham itself; but the neighbourhood, including several populous towns, also demands our attention: some of these towns participate in the manufactures of Birmingham; others carry on manufactures little if at all followed in Birmingham. Ponty-pool, in Monmouthshire, was formerly famous for its manufacture of japan-ware; but it is now continued there only on a very small scale, by the descendants of the family that first established it. At Birmingham, Bilston, and Wolverhampton, however, it is carried on with great spirit and success, and to a considerable extent. Wolverhampton also very largely partakes with Birmingham in the manufacture of screws; but it is particularly noted for the skilfulness of its locksmiths, in constructing locks, which are exceedingly curious; some of them partaking of the nature of clock work, and being of very minute size. A great part of the iron-mongery is made by the farmers of the adjacent country, (who, as well as the females, are regularly brought up to the business,) and sold by them to the great manufacturers. Saddlers iron-mongers are a class of manufacturers, some of whom are found in Birmingham, but who chiefly reside in Wolverhampton and Walsall; they cut out bridles and stirrups, and also manufacture and fasten on the iron work belonging to them. But the most extensive, as well as the most curious branch of the hard-ware manufacture, carried on in the vicinity of Birmingham, is the nail trade. Very

Screws, locks, &c.

ails.

few nails are made in the town itself; but in Dudley, Westbromwich, and Stourbridge, and in all the country round these places, the making of nails is the chief employment. It is supposed that in the nailery district, at least 30,000 people are employed. This manufacture is almost entirely carried on in the houses and cottages of the labourers. Men, women, and children, all work at it, and the display of forges at the doors of the houses is very striking. All the work is done by the piece,—bundles of iron being delivered to the work people, out of which they are expected to make a certain quantity of nails. In no trade, perhaps, do the labourers work so hard as in this. With their utmost efforts, from early in the morning till late at night, a man can seldom earn more than twelve or fourteen shillings a week. Nails used to be exported to the United States. None are sent to the Continent. This trade, which formerly used to be very extensively diffused over most parts of England, is now almost entirely confined to the neighbourhood of Birmingham. There are, however, manufactures of them at Little Dean, in Gloucestershire, Halesowen in Shropshire, and some other places. They were also made at Chowbent, in Lancashire, till the cotton trade superseded them.

heffield.

The period at which manufactures were established at Birmingham, is comparatively recent; but Sheffield has been the staple for iron manufactures since the year 1297, at which time falchion-heads, arrow-piles, and an ordinary sort of knives called whittles, mentioned by Chancer, and still known by that name in the north of England, were made. But it was not till towards the middle of the 17th century, that the articles of razors, knives, and files, for which it is at present so deservedly famous, were manufactured. It has been remarked, that for near a century succeeding, the Sheffield manufacturers discovered more industry than ingenuity or enterprise; and it was not till the middle of the last century, that they opened an immediate trade with the continent. About this time also, buttons of plated metal, sauce-pans, tea-urns, and candlesticks, were first made. Since this period, the manufactures of Sheffield have been progressively advancing.

The hardware manufacture is not confined to the town of Sheffield, but is spread over a district called Hallamshire, which extends six or seven miles to the west of it. The manufacturing concerns are under the superintendence and management of a corporation, stiled the Company of Cutlers of Hallamshire. This corporation was established in 1625, and an amendment was made to it in 1791. It is governed by a master, two wardens, six searchers, and twenty-four assistants. The master is elected annually, on the last Thursday in August, having previously passed through the inferior offices.

Difference between manufactures there, and at Birmingham.

In the neighbourhood of the town, a great number of works are erected on the river Don, for forging, slitting, and preparing the iron and steel for the manufactures. These differ in several respects from the manufactures of Birmingham. In the first place, copper and brass, as well as iron and steel, are wrought in the latter place; whereas, at Sheffield, very little of the former metals are used. Secondly, The articles made at Sheffield are more generally articles of real utility; some undoubtedly are articles of luxury, but there are no toys. Lastly, Its articles, in general, are much larger than those of Birmingham. The following list of the principal trades in Sheffield, if compared with the list we gave of the trades of Birmingham, will point out in what they agree, and in what they differ: Knives, scissars, anvils, silver and plated goods, skaits, joiners tools, saws, fenders, fire-irons, horn-buttons, horn ink-stands, bit-maker, razor straps, files, stove-grates, candlesticks, steel-refiners, wool-shears, haft-presser, silver-smiths, braziers, and tin-smiths tools, cut-nails, spades, shovels, scythes, sickles, table-fork-blades, snuffers, cork-screws, nut-crackers, steel cats and dogs, lancets, desk-knives, tea-pot handle and knob manufacturer, buttons, coach-harness, weighing machines, brass ink-pots, powder flasks, shot bolts, bayonets, wafer-seals, saw-files, shoe, cooks, and butchers knives, combs, &c. &c.

List of manufactures.

Remarks.

The plated ware made at Sheffield, (with the exception of plated saddlery,) is deemed much superior to that made at Birmingham: their files also have long been in the highest repute; of the scythes and sickles, which form an extensive branch, the coarsest are sent to Russia; and a finer sort were exported to America. The conversion of iron into steel, forms a very considerable branch of the manufactures of this town; and the mechanics who are expert at this process, receive as large wages as any that are given. Great part of the manufactures are carried on by men of small capital; and not so generally in workshops or factories as is the case in Birmingham.

The population of Sheffield, and the manufacturing district round it, is estimated at 60,000; and it is computed that 18,000 are directly employed in the different branches: the proportion of men to women is nearly as two to one. The gross value of the manufactures is supposed to be upwards of L.1,000,000, probably L.1,200,000; of these about one half are for home consumption; one-third used to be exported to America, of these, knives, forks, and saws, formed a large proportion; and the remainder were principally exported to the continent. Prior to the introduction of machinery, this place was observed to abound in cripples, but it is by no means the case at present.

Files.

Files have been mentioned as an article, in the manufacture of which Sheffield excels: they are also made of a superior quality, and in great numbers, in Lancashire, particularly at Prescot: cutlery and steel goods are manufactured at Salisbury. Cirencester is noted for its curriers knives, which are highly valued throughout Europe and America. At Abberford in Yorkshire, formerly the seat of an extensive pin manufactory, the wire-drawing business is now carried on with considerable success; this trade is also followed at various other places. Pins are manufactured at Gloucester, Reading, Sheffield, Warrington, Waltham Abbey, Bristol, London, &c. Needles at Redditch and Feckenham in Worcestershire, Alcester in Warwickshire, &c. Fish-hooks at Carlisle. Iron hoops at Crayford in Kent, &c. Tin-plates at Caerleon, Caermarthen, and Kidwelly; the last place is particularly noted for this manufacture, the tinned iron plates which are made there, being sent not only to every part of the kingdom, but to every trading port in Europe.

Value.

The average amount of the real value of the different articles, made of iron and steel, annually exported, is between L.3,000,000 and L.4,000,000; the value of articles manufactured of copper and brass exported, seems rather to be on the decline; in the years 1799 and 1800, the official value was between L.800,000 and L.900,000; whereas for three or four years past, it has varied between L.200,000 and L.300,000. The value of all the articles made of iron may safely be rated at L.10,000,000; and the number of persons employed at 200,000. The

Number of persons employed.

value of all the articles made of brass and copper is about L.3,000,000; and probably the number of persons employed about 50,000; and the value of the steel plating and hardware manufactures, including the toy trade, cannot be estimated at less than L.4,000,000; the number of persons employed being at least 70,000. Thus the total amount of the value of all these branches of manufacture from different metals, carried on in England and Wales, may be estimated at L.17,000,000; and the number of persons employed at 320,000.

Watch movements.

Under this head may be classed the manufacture of watch-tools and movements, which is carried on to a considerable extent, and with great ingenuity and skill, at Prescott, in Lancashire, and its neighbourhood. This place has already been mentioned for the excellence of its files. They are entirely of the smallest size; and it is supposed that the celebrity of this place for watch-movements, is principally owing to the superior quality of their files and tools. The drawing of pinion-wire had its origin at Prescot; and the manufacture of watch tools has been carried on beyond the memory of the oldest watch-makers. The workmen likewise excel in what is called motion-working, such as dial-wheels, locking-springs; hour, minute, and second hands. Main springs, chains for movements, and watch-cases, were not part of the original manufacture, but are now made here. All the branches of this curious and ingenious trade are, however, gradually removing to Liverpool, in the same manner as the fustian trade, which originated in Bolton, has centered in Manchester. The tool and watch-movement makers occupy small farms in conjunction with their manufacturing business: in this circumstance they resemble the weavers about Manchester. A manufactory of watch-spring chains has been established, within these few years, at Christchurch in Hampshire, in which many children are employed.

Earthen-ware.

English earthenware forms a branch of its manufactures of considerable importance. It is made with the greatest taste, and in the greatest variety, at the potteries in Staffordshire. The towns and villages that are so denominated, extend about seven miles, commencing about a mile from the borders of Cheshire, and terminating at a place called Lane-end. Of these villages, Burslem and Etruria are the most remarkable: The first is the ancient seat of the manufacture, earthen wares of one kind and another having been made there for centuries. Etruria belongs solely to Mr Wedgewood, whose father gave to the Staffordshire ware all the celebrity that it has so deservedly and universally acquired. Besides earthen-ware, china-ware is also manufactured in the pottery district.

The clay for this manufacture is brought principally from the isle of Purbeck in Dorsetshire, and from Devonshire; the flint from Greenhithe in Kent, whence several thousand tons are shipped annually: these, and other raw materials, are also brought from Cornwall, Hampshire, Sussex, and Wales. It is computed that nearly 40,000 tons of shipping are annually employed in bringing these materials to Liverpool. When the American trade was open, about 30,000 tons were employed in exporting the manufactured articles to the United States; and nearly as many tons in carrying them coastwise, besides what is sent by the canals. The number of packages exported from Liverpool, between 1803 and 1811, varied from 25,000 to 47,000.

The population of the pottery district is from 38,000 to 40,000, of which about 15,000 or 20,000 are employed in this manufacture. Women and children are employed, as well as men; and a family of three or four children will, with their father and mother, in good times, earn from 40s. to 45s. a week. They live in cottages of from L.5 to L.8 annual rent; and, in general, are healthy, industrious, and well-behaved. It is customary to hire them from Martinmas to Martinmas, allowing them a fortnight's holidays in winter; of course, when the frost is very severe, they cannot follow their work.

Earthen-ware is made in various other parts of England; and china-ware, of a very superior quality, at Worcester, Derby, and Colebrookdale.

In consequence of the great improvements that have been made in this manufacture, and the introduction of many new and beautiful wares, both for our own use and foreign markets, the annual value of the whole will probably not be over-rated at L.2,000,000; nor the number of persons employed at between 35,000 and 40,000.

Glas

The manufacture of glass is of very early date in this country, having been introduced, it is said, about the end of the 7th century; but it was not till 900 years afterwards, that the manufacture of fine glass was begun in London. About the beginning of the 17th century, a patent for making glass with pit coal was exempted from the operation of the law against monopolies. The importance of this manufacture now becoming apparent in the year 1670, manufacturers were procured from Venice; and within 15 years afterwards, the French refugees, to whom we are indebted for so many improvements in our manufactures, contributed to the improvement of this, especially in the crystal branch of it. From the beginning till the middle of the 18th century, we exported large quantities of glass bottles to Holland; but at the latter period, in consequence of the erection of a number of glass-houses in the United Provinces, this trade declined.

The year 1773 forms an important era in the history of the English glass manufacture. It was in this year that the British Plate-glass Manufactory, incorporated by act of parliament, erected their extensive works at Ravenhead, near St Helen's, in Lancashire. Their buildings cost nearly L.40,000. The manufacture was introduced by workmen from France, from which country we had previously imported our plate-glass. The article made at Ravenhead, soon rivalled the French glass in its perfection and brilliancy of colour, as well as in the size of the plates. In the year 1789, a steam-engine was erected, to grind and polish the plates of glass, which not only saved a great deal of labour, performing as much work as would employ 160 men, but did it with more exactness and expedition. Cast plate-glass, with concave and convex mirrors, are now made superior to any imported from the Continent. The works cover about 20 acres of ground; and nearly 300 persons are usually employed in the various processes of melting, casting, blowing, polishing, &c. Plate-glass is also made now in London and Liverpool, the Plate-Glass Company having been incorporated only for 21 years.

Manufactories of glass of all the other kinds are numerous in this country. Bottle-glass is made at Bristol, as well as crown and flint-glass. In Newcastle, Sunderland, and Hartley-pans, there are a great many houses for making crown, common window glass, flint glass, and green bottles. Stourbridge, Warrington, and several other places, have also their manufactures of glass of various kinds. Near Darlington, there is a mill for grinding optical glasses. This manufacture is so scattered, that it is difficult to form an estimate of its annual value, or of the number of hands employed in it. The former, however, may amount to upwards of L.1,000,000; and the latter to between 30,000 and 40,000.

Paper. Paper, which is now made in such perfection in England, and to such a large annual amount, was almost entirely imported from the Continent, especially from France, till near the end of the 17th century. In 1685, this manufacture was much improved by the French refugees; yet we are informed by King, in the British Merchant, that before the revolution, there was hardly any paper made here, except brown. In 1690, white paper was first made; and, in 1695, all the kinds, white, blue, and brown, were much improved. In 1721, according to King, there were 120 vats within 60 miles of London, besides several more in Yorkshire, which all made white paper. These, together with some paper mills in Scotland, are said to have made more than 300,000 reams, which, at that time, was two-thirds of the whole consumption. Mr King mentions, that, in England, with five men to each vat, they did not dispatch above eight reams in a day; whereas, in France, with the same number to a vat, they dispatched above nine reams. At this time (1721) paper was valued at 5s. a ream. In 1783, the annual value of the paper manufactured in the kingdom was estimated at L.780,000; and it was said to be increasing. At present, besides making sufficient of almost every kind for our own use, we export it to a considerable amount. The annual value of the article is probably rather more than L.1,000,000, and the number of persons employed about 30,000. There are paper mills on almost every stream, the water of which is sufficiently pure for the purpose; but perhaps they are most numerous and extensive in the vicinity of the metropolis, particularly in Kent, near Maidstone; in Hertfordshire, Surrey, Buckinghamshire, Bedfordshire, Hampshire, &c. At Freefolk, in this last county, the paper for the Bank of England notes has been manufactured ever since the reign of George I.

Hats. Hat-making is a very considerable branch of English manufacture, which is now brought to great perfection. It seems to have been improved, like the manufacture of paper, &c. by the French refugees. It is carried on in various parts of the kingdom. At Newcastle-under-Line, coarse or felt hats are made, under an incorporated company of felt-makers. Immense quantities of these hats are exported to the West Indies, for the use of the negroes. Felt-hats are also made at Rudgley, &c.; and other kinds of hats at Stockport, Oldham, Manchester, Ashby de la Zouch, Burton, Atherstone, Cockermouth, Hereford, Hexham, Newcastle-on-Tyne, &c. But, in point of quality, no hats are equal to those manufactured in London. Straw hats are principally made at Dunstable.

Various other manufactures. The other manufactures of England we can only name; and probably from their great variety, our enumeration will not be complete. Gun-powder is made at Battle, Dartford, Hounslow, Waltham Abbey, Feversham, &c. Gun flints are a manufacture almost peculiar to England. Shot are cast at Chester, the Borough, &c. Copperas works are established in the counties of Durham and Northumberland, in the Isle of Shepey, in Kent, &c. Aquafortis is made at Bradford in Yorkshire. Sal-ammoniac at Newcastle, Leeds, and a few other places. White-lead extensively at Newcastle; and white and red-lead at Chester. There are snuff-mills at Chester, Bristol, Liverpool, and Gloucester. Sugar refineries at London, Bristol, Liverpool, and Newcastle. Soap manufactories are established in many parts of the country; but London, Bristol, Newcastle, and Hull have them, perhaps, on a more extensive scale than other places. There are also manufactures of turpentine, linseed, rape, and other oils. The preparation of horse hair, furs, and feathers, employ a good many people. Brick-making is extensively carried on in the vicinity of London, and near those towns where stone is scarce and dear. But it would be endless, we perceive, even to attempt an enumeration of all the various kinds of manufactures of England. We shall, therefore, conclude this branch of our subject, by mentioning those manufactures, which are either confined to London, or carried on there to the greatest extent, and in the highest perfection; and with enumerating the great variety of manufactures that are concentered in some of our large provincial towns, since the concentration of such a variety is perhaps little less astonishing, than the extent and magnitude of the whole through the kingdom at large. By thus concluding this part of our subject, we shall also have an opportunity of mentioning some kinds of manufactures which we may have overlooked.

In London. The manufactures of London consist chiefly of fine goods, and articles of elegant use, brought to more than the ordinary degree of perfection; such as cutlery, jewellery, articles of gold and silver, japan ware, cut glass, (drinking glasses, cut in London, have been sold so high as three guineas per glass,) cabinet and upholstery work, and gentlemen's carriages. The amount of capital, and number of men employed in the manufacture of these two articles, are not less surprising, than the elegance of taste and high perfection which are displayed in the articles themselves; both of which, especially carriages, are exported to a great amount. It is believed that the trade of a coach currier is carried on nowhere but in London. That of a gold-beater, also, is either exclusively confined to the metropolis, or seldom seen elsewhere. Clocks and watches, particularly the latter, are a very considerable article of manufacture; the parish of Clerkenwell containing, it is said, upwards of 7000 watch-makers. The value of the watches and marine chronometers made in London and its neighbourhood, is above £1,000,000, independent of clocks; the watch-makers of the metropolis making watches, not only for all the British dominions, but also for all the civilised world. London is likewise celebrated for the exquisite skill in the construction of its optical and other philosophical instruments. Besides these kinds of manufactures, and others which have been incidentally mentioned before, such as hats, &c. porter breweries, vinegar works, copperas works, calico-printing, distilleries, glue manufactories, iron founderies, oil mills, saltpetre works, vitriol works, turpentine manufactories, manufactures of whitening, dye-houses, &c. may be mentioned. Muffs, an article of no inconsiderable importance, considering the price which some of them cost, are principally manufactured in London; here also are chiefly found feather-dressers.

In Bristol. Perhaps in no provincial town is there a greater variety of manufactures than in Bristol. Some of them have been already mentioned; but we shall enumerate them all, in order that an adequate idea may be formed on this subject. Varnishes of uncommon beauty are made here; hats; leather, both tanned and dressed in oil; saddlery, shoes, white and red lead, gunpowder, hard white soap of the best quality in great abundance, earthen-ware, glass, a brass-rolling manufactory, works for smelting lead and making shot, iron founderies and slitting mills, tin works, a manufactory of zinc out of calamine, pins and other brass articles, turpentine, sulphur and vitriol works, glass-making, refining of sugars, and distilleries, are to be seen in this city; most on an extensive scale, and conducted with great spirit and enterprize.

In Newcastle. Newcastle-on-Tyne probably is next to Bristol in the variety of its manufactures. In this town, or its immediate neighbourhood, are iron furnaces; wrought iron works, in some of which anchors and various articles of naval ironmongery for the dock-yards are made; works for smelting lead, refineries of lead, lead manufactories for rolling sheet lead, and converting pig-lead into ceruse and minium for pigments; patent shot, colour manufactories, a manufacture of Prussian blue, glass works, potteries, manufactories of coal tar and lamp black, copperas manufactories, manufactories of sal-ammoniac, glauber's salts, soda, brown paper mills, soaperies, sugar-refineries, salt works, and a manufactory for spinning linen yarn.

In Hull. At Hull, there are manufactures of sail-cloth, sugar-houses, soap works, oil-mills, iron founderies, lead manufactories, a manufacture (if it can be so called) where mill-stones are formed of the French bur-stone, several whale-oil yards, large breweries, saw-mills, flour mills, &c.

In Liverpool. In Liverpool and its vicinity are salt refineries, sugar-houses, a vast number of manufactories for tobacco-pipes and pottery, iron founderies, breweries, a steam-engine for cutting and flattening iron, vitriol and white-lead works, mills for cutting dye-woods, snuff-mills, salt and copperas works.

Concluding remarks. Thus have we endeavoured to give as accurate and complete an account of the nature and state of the various manufactures of England, as our information and our limits would permit. We are sensible it must necessarily be imperfect or erroneous in some particulars; but we trust in none of considerable importance. As an apology for at least some of the omissions or errors with which we may be chargeable, we must, in justice to ourselves, remind our readers, that several of the most extensive and valuable of the manufactures of this country have been for several years past in such a state of fluctuation, from the extraordinary character and effects of the war, out of which we have just rescued ourselves, that it is almost impossible to give such an account of them, as will at once apply to their present state, and serve for a general description. We have therefore preferred, in many instances, describing them as they were in their settled and regular state, to attempt giving a description of them during the vicissitudes to which they were very lately so frequently and rapidly subject, and from the effects of which they have not yet recovered, so as to regain their wonted regularity and steadiness.

It is scarcely necessary to call upon the reader for his admiration of the wonderful proofs which these manufactures afford, of the skill, industry, enterprize, and wealth of the inhabitants of this country. In ancient or in modern times, there is no parallel to what England exhibits at this moment; and such is the state of apparent perfection to which most of her manufactures have reached,—so completely subservient to their will have her inhabitants brought the most refractory and stupendous powers of nature,—such a practical demonstration have they exhibited of the truth of Bacon's maxim, that knowledge is power; that did we not compare what our manufactures are now with what they were half a century ago,—did we not perceive, even while we are pronouncing them perfect, new improvements taking place, by means of which, either their quality is bettered, or human labour is saved; and did we not know that our countrymen, in their capital, their industry, their skill and experience, possess almost inexhaustible sources of improvement, we should be inclined to pronounce, that the manufactures of England had reached that point of perfection, beyond which they could not advance.

In the following Table is given the number of families engaged in trade, manufactures, &c. in each county, and the annual amount of income derived from these sources, as returned to the House of Commons.

TABLE VII.

Counties in England.	Families chiefly employed in trade, manufactures, &c.	Amount of annual profits, from professions, trades, &c.		
Bedford	4,155	£ 94,720	13	3
Berks	7,584	272,582	7	8
Buckingham	8,424	218,406	8	8
Cambridge	5,303	217,088	4	11
Chester	23,043	276,279	19	6½
Cornwall	10,954	277,068	8	9
Cumberland	11,448	198,607	11	6
Derby	15,825	207,089	1	8
Devon	30,977	711,318	11	10
Dorset	9,607	189,869	4	10
Durham	17,094	237,105	0	0
Essex	14,182	571,398	8	4½
Gloucester	29,986	864,565	6	0½
Hereford	5,044	62,961	1	8
Hertford	7,192	249,578	11	6
Huntingdon	2,205	107,588	7	0
Kent	27,996	1,346,654	14	3
Lancashire	114,522	1,799,084	4	6
Leicester	17,027	296,470	8	4
Lincoln	13,184	366,984	17	3
Middlesex	135,398	13,420,252	15	6
Monmouth	4,812	103,546	2	0
Norfolk	23,082	486,230	11	0
Northampton	12,100	187,867	17	10
Northumberland	16,547	472,779	12	10
Nottingham	18,928	310,708	0	9
Oxford	7,655	297,338	14	6
Rutland	1,028	33,860	1	8
Salop	16,744	296,913	17	3
Somerset	23,732	1,295,862	17	4
Southampton	18,024	848,850	9	8
Stafford	34,011	495,120	19	0
Suffolk	15,180	483,850	15	6
Surrey	35,160	1,623,131	16	6
Sussex	10,754	390,659	15	8
Warwick	29,775	601,498	18	8
Westmoreland	2,870	54,659	19	10
Wilts	14,857	322,670	14	1
Worcester	16,865	286,222	18	0
York, E. Riding	12,926	1,840,421	2	10
—— N. Riding	10,864			
—— W. Riding	86,522			
Carry forward	923,588	31,867,120	7	1¼

Counties in Wales.	Families chiefly employed in trade, manufactures, &c.	Amount of annual profits from professions, trades, &c.		
Brought forward	923,588	£31,867,120	7	1½
Anglesey	1,453	7,913	0	10
Brecon	2,239	30,757	0	0
Cardigan	1,913	11,659	0	0
Caermarthen	5,256	27,378	0	0
Caernarvon	2,687	17,703	3	9
Denbigh	3,447	28,866	18	4
Flint	3,009	14,806	4	10
Glamorgan	7,915	132,121	0	11
Merioneth	1,270	4,568	5	7
Montgomery	3,164	20,298	15	0
Pembroke	2,848	44,154	5	6
Radnor	843	3,753	10	0
	959,632	£32,210,599	11	10¼

CHAP. X.

Fisheries. Trade and Commerce. Shipping. Circulating Medium. Finance. Navy. Army. Population.

Fisheries.

The fisheries of England consist of those which are carried on in the rivers, and on the coasts; and of those which are carried on at a distance from the country. Of the latter description, are the Newfoundland fishery, the Greenland and Davis' Straits fishery, and the South Sea fishery. Of the former description, the most important are the salmon fishery, and the fishery for herrings, mackarel, pilchards, oysters, turbot, &c.

Salmon fishery.

Although salmon are taken for sale in most of the rivers in England, yet there is no river in which they are very abundant, or the source of considerable profit, except the Tweed. In this river, there are 41 fisheries of considerable value, besides smaller ones. The former extend upwards about 14 miles from the mouth. Above this, they are of trifling importance. The rent of the whole is nearly L.16,000. The expence attending the servants' wages, nets, boats, &c. amounts to nearly L.10,000 more. The number of boats employed is generally about 80, and of men between 300 and 400. Nearly the whole of the salmon caught on the Tweed was formerly sent up to the London market pickled; but within these 20 years it has been sent up packed in ice.

Herring.

The herring fishery on the coasts of England is not nearly so extensive and valuable as that on the coast of Scotland; and within these 20 years it has been on the decline. It may be considered as extending from the coast of Scotland to the entrance of the English Channel, on the east and south-east side; but Yarmouth is generally regarded as the centre of it. Herrings are also caught on the west coast of England, but not in such numbers. The commerce in herrings is of very ancient date. Madox, in his History of the Exchequer, relates, that in 1195, the town of Dunwich was obliged to deliver 24,000 herrings to the king; and, in the reign of Edward III. the herring fair of Yarmouth (which had existed for some time before) was regulated by statute. The Mediterranean market for this fish, however, does not appear to have been opened, or at least to have been of much importance, before the beginning of the 17th century; and while it continued uninterrupted, the fishery off the coasts of England were extensive and lucrative, notwithstanding the Dutch greatly participated in them. In the year 1760, 205 vessels were employed on the Yarmouth coast, of from 30 to 100 tons; and it was computed that about 6000 men, women, boys, and girls, were supported by this fishery. At the same time, between 30 and 40 vessels sailed from Folkstone, Hastings, &c. on the herring fishery. For about 20 years preceding 1760, the annual capture of herrings on the Norfolk coast, was above 47,000 barrels, of which 38,000 were exported. In 1782, it had declined greatly, only 94 vessels being employed on the Norfolk coast. In the year 1812, there were at Yarmouth, not on tonnage bounty, only five ships, of the burden of 267 tons, with 30 men. These caught and cured 560 barrels; and on shore there were cured 1686. At this period, there were on tonnage bounty three ships, the tonnage of which was 170 tons, and the crew consisted of 37 men and boys. The number of barrels cured by them was 2132. The number of barrels of white herrings landed or cured on shore 4378; and 1915 branded for bounty:—none were exported. At Whitehaven, the other English station appointed by the act for the encouragement of this fishery, there were, in 1812, 4691 barrels of white herrings landed or cured on shore; 347 barrels branded; and 3013 exported. The cause of the great decline in this fishery is sufficiently obvious. The demand for cured herrings in the principal market for them, the Roman Catholic countries in the south of Europe, was interrupted, and nearly destroyed, in consequence of the war; while the other market, the West Indies, where they are used as food for the slaves, is supplied more cheaply from Scotland. Besides, from the increase of wealth and luxury, the home consumption, notwithstanding all the attempts that have been made to extend the use of this fish, has also diminished.

Mackarel.

The mackarel fishery is entirely confined to the supply of the home market. They are principally caught between Yarmouth on the east and north, and the coast of Hampshire on the south and west, being seldom found in any abundance to the north of Yarmouth, and to the west of the Hampshire coast, being in a great measure neglected for the pilchard fishery. The principal market for mackarel is London, where, on an average, upwards of 1,000,000 are sold annually.

Pilchard.

The chief pilchard fishery is along the coasts of Dorsetshire, Devonshire, and Cornwall, especially the last. Fowey, Falmouth, Pensance, and St Ives, during the flourishing state of this fishery, having exported a far greater quantity than all the other ports of these counties. But this trade depending for its prosperity on the same causes as the export trade in herrings, has declined very much latterly. The annual export on an average of 10 years, from 1747 to 1756, was about 30,000 hogsheads from the four ports just mentioned; whereas, in the year 1782, it had fallen to about 12,000 hogsheads. Even in this declined state, it afforded employment to 30,000 fishermen, besides the seamen employed in carrying the fish to foreign markets, and 4000 or 5000 people connected with the shore business of the fishery. At one period, the Cornwall pilchards were so much in request in the Italian States, that the orders from them for lead, tin, copper, &c. were often conditional, that if such a quantity of pilchards could not be sent, the other articles would not be received. At present, the pilchard fishery is in a much worse state than it was even in the year 1782. Dartmouth and Falmouth are now its principal seats. In the former, the number of vessels employed in catching the fish, and conveying them to market, is upwards of 300. At Falmouth, the number is rather greater.

Oyster. The oyster fishery is principally carried on at Colchester in Essex, Wells, Faversham, Milton, the Swales of the Medway, Queenborough, Rochester, Sea Salter, Pool, Tenby in Pembrokeshire, and Port Inon in Glamorganshire. The Colchester oysters are the most famous. Most of these are brought from the little creeks between Southampton and Chichester, and are only fattened at Colchester. The oyster fishery at Poole is very considerable, supplying the London market for two months every season; about 40 sloops and boats being employed in this traffic, the receipts generally averaging between L.7000 and L.8000. The Bristol, Bath, and Gloucester markets, are supplied chiefly from Port Inon; 200 fishermen, and five or six sloops, being engaged on the oyster fishery there. It is calculated, that about 10,000 people are employed in this fishery along the coast of England.

The other fisheries on the coast are comparatively of little importance; they consist principally of turbot, cod, lobsters, &c. The fisheries for the two latter are chiefly on the east and north coasts, while the most extensive and valuable turbot fisheries are along the coasts of Norfolk, Suffolk, Essex, and in the English Channel.

Fishing vessels in 1785. We are not in possession of any complete and authentic documents, by means of which we can lay before our readers an account of the total number of vessels and men employed in the fishing trade of England at the present time; but, in the year 1785, there was laid before the Treasury, by the commissioners of the customs, an account of the total number of ships and vessels, their tonnage, and number of men, belonging to each respective port in South Britain, that traded to or from foreign parts, coastwise, or were employed as fishing vessels, including each vessel, her tonnage, and men but once, from which we shall extract what relates to the fishing vessels.

Places.	Ships.	Tons.	Men.
Rochester	9	205	32
Sandwich	9	425	38
Deal	40	360	220
Dover	106	932	405
Rye	18	212	46
Shoreham	91	730	370
Hastings	44	320	108
Southampton . . .	13	90	26
Lymington	3	54	6
Cowes	54	1408	194
Poole	21	331	67
Weymouth	9	154	29
Lyme	5	100	9
Exeter	253	2112	847
Dartmouth	58	1380	230
Plymouth	40	1050	170
Fowey	60	450	330
Falmouth	10	90	16
Penryn	4	210	44
Biddeford	28	72	92
Carry forward	875	10,680	3279
Brought forward	875	10,680	3279
Minehead	12	94	25
Milford	18	350	90
Cardigan	35	175	164
Aberystwyth	36	284	140
Colchester	182	1370	180
Maldon	34	147	80
Leigh	16	470	48
Ipswich	16	480	32
Harwich	66	3070	256
Yarmouth	78	2194	786
Lynn	8	147	30
Wells	2	30	6
Boston	28	620	66
Hull	15	3956	579
Grimsby	16	80	32
Bridlington	5	75	25
Scarborough	10	150	50
Whitby	20	600	120
Stockton	6	120	30
Newcastle	14	4394	567
Berwick	9	360	36
Whitehaven	3	320	50
Beaumaris	16	74	66
Total	1420	30,540	6737

Newfoundland fishery. The Newfoundland fishery seems first to have been attempted about the year 1536; but no English colony was settled on the island till the year 1583. The details respecting it are either not very important, or not well ascertained, till the year 1731, at which time we found, from a judicious tract, entitled, "The Importance of the British Plantations in America," that the English made, one year with another there, about 200,000 quintals of fish, which, at twelve shillings the quintal, amounted to L. 120,000. This was deemed all clear gain, as the oil procured from the fish paid for salt, &c. In the year 1763, there were employed in this fishery 177 ships, of the burden of 17,268 tons, navigated by 2531 men, besides 116 ships, which brought out salt, or came in ballast to purchase the fish. In this year there were carried to foreign markets 493,654 quintals of cod, besides 1172 tierces of salmon. Towards the commencement of the American war, the Newfoundland fishery seems to have been on the decline, there having been in the year 1769, 354 fishing vessels; in 1770, 368; in 1771, 369; in the year 1772, 306; in 1773, 262; and in 1774, only 254. After the termination of the American war, and till nearly the commencement of the first French revolutionary war, the fishery revived; there having been in 1784, 236 fishing vessels; in 1785, 292; in 1786, 280; in 1787, 306; in 1788, 389; in 1789, 304; in 1790, 259; in 1791, 245; and in 1792, 276.

The prosperity of this trade depended, in a very considerable degree, on our being at peace with the south of Europe. This will sufficiently appear from the following official document: In the year 1790, there were exported from Newfoundland, 684,421 quintals of dried fish, of which 581,824 went to the south of Europe; and 6221 barrels of wet fish, of which 3667 went to the same parts. In the year 1791, there were exported 720,147 barrels of dry fish, of which 623,083 went to the south of Europe; and 7011 of wet fish, of which 4338 went to the same parts. These were years of peace; but in the year 1798, there were exported only

353,363 barrels of dry fish, of which 209,995 went to the south of Europe; and in 1799, 313,756 barrels, of which the south of Europe took off 238,953. The export of wet fish did not fall off in nearly the same proportion; indeed, in the year 1798, the falling off, compared with 1790, was very trifling, there having been exported in the latter year 6026 barrels, but then none of these went to the south of Europe. In the year 1799, the number of barrels of wet fish exported, amounted only to 3548, of which the south of Europe took 990.

The tonnage, and men employed, of course, fell off in a similar proportion. In the year 1790, the tonnage was 31,644, and the men 2608; in 1791, the former was 34,166, and the latter 2639; whereas, in 1798, the tonnage was only 15,838, and the men 1268; and in 1799, the tonnage was 14,322, and the men 1145. It is probable, however, that the Newfoundland fishery, which, at present, is as depressed as it was in 1799, will revive, now that we are at peace with the south of Europe. This fishery is almost entirely confined to a few harbours on the English Channel, of which Pool is by far the most considerable.

Greenland.

The English seem to have commenced their fishery for whales in the North Seas, about the year 1598, but the first voyage, expressly undertaken by them, for this purpose, was in the year 1611. At this time the Russian company sent two ships into the Greenland seas; and in 1636, King Charles confirmed this fishery solely to this company. They, however, soon relinquished it. The trade, after this, seems to have been abandoned, till the year 1725, when the South Sea company revived it; but they were very unfortunate, so that, in the year 1732, they sold all their ships.

In the year 1750, a bounty of forty shillings a ton was granted by government. At this time there were sent from England only 19 vessels, amounting to 6264 tons. The bounty, however, soon operated advantageously; for in 1756, there were 67 vessels. The French war commencing, the number again fell off; and in 1762, there were only 28. In the year 1770, they had increased to 50, which, on an average, were about 300 tons burden, and navigated each by 54 men, of whom six were apprentices.

From the year 1770, till the commencement of the American war, the Greenland whale fishery from England progressively improved, there having been, in 1775, the year before hostilities began, 96 ships, containing nearly 30,000 tons, employed in it. From this period it again declined, there having been, in the last year of the war, only 38 ships, of about 20,000 tons. As soon as peace was restored, however, the fishery revived very rapidly; in 1785, there were 136 vessels; in 1786, 162; in 1787, 219; and in 1788, 216. The number of seamen employed at this time was nearly 10,000; the ships were valued at L. 3000 each; their out-fit averaged L. 1000; and the wages of the men, and their expences on the home voyage, L. 300. From this great out-lay, and the low price of oil, &c. those interested in the trade petitioned for a larger bounty. In 1788, new regulations respecting the bounty were made; and in 1791, the men were protected, but the bounty does not seem to have been increased. At present, there generally sail from the ports of England, for the Greenland and Davis' Straits fishery, between 70 and 80 vessels, of the burden of between 20 and 30,000 tons, and navigated by about 3000 men. The ports from which they sail, are Hull, Whitby, Scarborough, Shields, Sunderland, Berwick, and London.

South Sea.

The South Sea whale fishery was not followed in this country till about the year 1776, where there were equipped 15 vessels of about 170 tons each. As the Americans had carried on this fishery before this period, four American harpooners were sent out in each vessel. The first voyage was not very successful, as they got only between forty and fifty tons of oil a-piece, yet the superior quality, and the price of it, advanced by the war from L. 35 to L. 70 per ton, were sufficient to encourage the merchants to persevere in the business. In 1778, 19 vessels were sent into the South Seas; but from some cause, not explained, in the following year, 1779, the number was reduced to four; and it continued under 10 till the year 1785, when 11 vessels were sent out: in 1788, the number of vessels were 42, and their burden 8637 tons; till the year 1781, all the vessels belonged to London; after that, Liverpool, and some other of the out-ports, began to participate in the trade.

In 1793, the first year of the war, the number of vessels was 38; the war, however, seems to have affected this fishery; for, in 1797, the number was reduced to 23; and it continued nearly the same till the conclusion of the war. At present, the number is again raised, there being usually between 35 and 40 vessels, the tonnage of which is between 12,000 and 14,000, and the number of men employed between 800 and 1000.

From this brief sketch of the fisheries of England, both domestic and foreign, it is sufficiently obvious that they are not carried on with nearly the same degree of enterprize and spirit which is displayed by the English in almost all the other branches of their trade. Yet frequent attempts have been made to extend and improve them: companies have been formed by individuals, and bounties granted by government. Whence then does it happen, that the fisheries of this country, especially those on the coasts of the island, are so imperfectly and languidly pursued? Probably, because in other branches of trade and commerce, we have made such great advances, and can secure, or at least render probable, such large profits, that the comparatively small profits which the fisheries offer to our commercial ambition, are not sufficient to turn the adequate capital aside into that channel.

In considering the trade of any maritime country, it naturally divides itself into three parts; the coasting trade, the inland trade, and the foreign trade: the last, strictly and properly speaking, constitutes its commerce. The two first are versant either about the supply of the inhabitants of the country, or they indirectly constitute part of its foreign commerce. They must be considered in the latter light, when they merely bring goods to the ports of shipment; and in the former light, when they contribute towards the interchange of articles of domestic consumption.

Coasting trade.

The coasting and inland trade of England, though of great importance and value, even when considered as confined to articles of domestic consumption, cannot be brought within an estimate at all approaching to the truth, the details being much too extensive and scattered, and many of them too minute.

Coal trade.

The coal trade comprises one of the most considerable branches of the coasting trade of this country; the coal ships on the east coast alone, belonging to Newcastle, Shields, Blyth, Hartley, Whitby, Sunderland, Scarborough, &c. amounting to about 1500 sail, of from 150 to 400 tons; the number of men employed in these vessels cannot be fewer than 12,000.

Statistics.

Coasting vessels in 1795.

According to the account drawn up by the Custom-house in the year 1785, already referred to, the number of coasting vessels at that period was 3445; their tonnage 256,648; and the number of men employed in navigating them 17,107: but this account seems to include the coal vessels. From the same statement, it appears, that the following ports had the greatest number of coasting vessels: Newcastle, 358; Sunderland, 258; Beaumaris, 249; Cardigan, 190; St Ives, 173; Hull, 165; Yarmouth, 104; Liverpool, 75; and Scarborough, 75. It is a singular circumstance, that, according to this statement, not a single coasting vessel belonged to the port of London.

In 1796.

In the year 1796, a committee of the House of Commons drew up a report on the London Docks, from which the following particulars respecting the coasting trade of London is extracted, which may serve to point out the great increase in this branch of trade, so far as relates to the metropolis; and we may safely infer a similar increase in the coasting trade between the different provincial ports. In 1700, the coasting vessels (including their repeated voyages) which arrived in the port of London, were only 5562; their tonnage, 218,100. In the year 1750, 6396, and their tonnage 511,680: in 1790, the number of vessels 9278, and their tonnage 927,800: in 1795, the vessels 11,964, and their tonnage 1,196,400: and in 1796, the vessels were 10,629, and their tonnage 1,323,532. From the report of the select committee, on the improvement of the port of London, in 1799, it appears, that in the year 1797, the number of vessels, (including their repeated voyages), which entered the Thames from the provincial ports, was 10,781, and their tonnage 1,360,823; and in 1798, the number of vessels was 10,133, and their tonnage 1,250,449. Considering, with respect to their tonnage, there were of coasters in 1798, 5873 vessels (including their repeated voyages), under 100 tons; 809 from 100 to 150 tons; 98 vessels from 150 to 200 tons; and 14 from 200 to 400 tons; the total number of vessels being 6844, and their tonnage, amounting to 500,636, besides 3289 colliers (including repeated voyages), the tonnage of which, on an average of 228 tons to each vessel, amounted to 749,813, making the total of vessels, as before stated, to be 10,133, and the total of tonnage 1,250,449. If from these we deduct one tenth as the proportion of Scotland, we shall gain a pretty accurate idea of the coasting trade from the provincial ports of England to the metropolis, in the year 1798. Of these coasters, the port of Hull sent nearly one-fifth, (not including the colliers), there being 100 from Hull, and 396 from the other ports of England, and 32 from the ports of Wales.

There are no data on which a calculation can be grounded of the value of the coasting trade of England. In the evidence lately given before the House of Commons, on the establishment of a new chartered marine insurance company, it was calculated that the value of the goods carried coastwise, was one half of the value of the exports and imports; but it is not possible to ascertain whether this calculation comes near the truth or not.

Inland trade.

It is still more difficult to form an estimate of the inland trade of England; nor can any person even imagine its extent, who has not considered the wonderful and numerous facilities of conveyance, which, springing at first from the commercial enterprize and wealth of the country, have in their turn served to increase and extend it. The state of the roads in almost every part of England; the almost infinite number of carriages, waggons, &c. which are either conveying our merchants and manufacturers, or their goods, without intermission, and in the most regular, certain, and expeditious manner; but, above all, the numerous canals by which the country is intersected, in almost every direction, must be taken into the account, if we wish to entertain any thing like an adequate idea on this subject. Nor shall we yet be doing justice to our country, if we do not recollect that all these facilities of conveyance are the work of little more than half a century. The highways of Britain were not equal in goodness to those of foreign countries, when the peace of Aix-la-Chapelle was concluded. From this time to the death of George II. great exertions were made to improve the state of the roads; and during the first 14 sessions of the reign of George III. the various road laws were collected into one act, and no fewer than 452 acts were passed for repairing the high ways of different districts. Since that period, not a session has passed in which acts for repairing and improving the high ways have not been enacted.

The evidence respecting the extent and rapid increase of our inland trade, derived from the numerous canals which have been made, since the commencement of the present reign, is not less striking and unequivocal. A very early attention was paid to the navigation of our rivers; and from the Revolution, to the death of George II. many streams had been rendered navigable: a still greater number, however, have been rendered commodious to internal commerce, during the present reign, besides the more valuable improvement of canals; nineteen acts during the first fourteen sessions of this reign having been passed for making artificial navigations; and subsequent sessions have witnessed nearly an equal attention to this mode of facilitating internal commerce.

It would carry us far beyond our limits, even to enumerate all the canals which now exist in England. On this subject, we must refer our readers to the article Inland Navigation; and content ourselves with remarking, that nearly all the great manufacturing towns are connected with one another by means of canals; that by them they can receive most of the raw materials, which they respectively work up; and that by far the largest proportion of the manufactured articles are dispersed over the kingdom, or sent to the ports whence they are embarked to foreign parts, by means of inland navigation.

Value of the domestic trade.

The foreign trade of this country is generally considered of much more importance than its domestic trade; but this idea appears to us to be erroneous: the foreign trade is undoubtedly much more imposing in its aspect, and the extent of it is more easily ascertained; but the real value of the domestic trade, if properly investigated, will be found to be much greater. Let us only reflect on the population of England and Wales, which is upwards of ten millions; and on the industry and wealth of that population: our foreign customers are undoubtedly more numerous, but they are far behind what may be called the domestic customers in industry and wealth. Even on the very moderate computation, that the average annual expence of each individual of the ten million inhabitants, amounts only to L.20, the annual domestic consumption will amount to the enormous sum of L.200,000,000.

Commerce

We come now to the consideration of the foreign trade of England; and in describing it, we shall enumerate the most important and material articles which England imports from each particular foreign country, and which she exports into each particular foreign country; and give a statement of the value of the exports and imports, where they have been ascertained, and also of the number of vessels employed in each branch of foreign trade. We shall conclude this part of our subject, by a statement of the whole exports and imports, and of the tonnage, both domestic and foreign, which annually enter or leave our ports.

Trade to Denmark.

The principal imports from Denmark, are hides, bar iron, kelp, furs, tar, and timber and boards of different kinds: the principal exports to this country are, hardware goods, lead, tin, coals, earthen-ware, glass, salt, cotton goods, woollen goods, hats, tanned leather, refined sugar, drugs and dye stuffs, tobacco, &c. The real value of the exports to Denmark, from 1798 to 1803, was on an average about half a million; from 1803 to 1807, when the attack on Copenhagen took place, the value of the exports varied from L.2,000,000 to L. 6,000,000. The number of vessels employed in the trade to Denmark, in times of peace, was generally (including their repeated voyages) of English vessels 200, of foreign vessels 800.

To Russia.

The principal articles of import from Russia are, pearl and potash, bristles, cordage, flax, hemp, iron, linens, pitch, tar, tallow, timber, &c.; the principal articles of export are, coals, salt, sal ammoniac, lead, tin, hard-ware, earthen-ware, glass; woollen, cotton, and silk goods; refined sugar, dye stuffs, &c. The official value of the imports from Russia is generally about L.2,000,000: of the exports to Russia, about half that amount. The number of vessels employed in the trade to this country in times of peace, was generally (including their repeated voyages) of English vessels about 500, and of foreign about 100.

To Sweden.

The principal articles of import from Sweden are flax, iron, pitch, tar, timber, &c. of export to Sweden, coals, lead, tin, hardware, earthenware, salt, cotton and woollen goods, sugar, coffee, tobacco, &c. The official value of the imports from Sweden is generally under L.500,000; of the exports to Sweden under L.100,000. The number of English vessels employed in this trade is generally about 50; and of foreign about 250.

To Poland.

The principal articles of import from Poland are corn, particularly wheat, pearl and pot ashes, timber, &c.; of exports, hardware, cotton goods, sugar, coffee, drugs, spices, &c. The official value of the imports are generally about L. 300,000; of the exports under L.50,000. The English vessels employed in this trade are about 30, and the foreign vessels about 20.

To Prussia.

The principal articles of import from Prussia are corn, particularly wheat and oats, flax, hemp, pearl and pot ashes, timber, &c.; of export, salt, woollen and cotton goods, hardware, earthenware, glass, sugar, coffee, and various articles of East India produce. The official value of the imports is frequently near a million; of the exports rather less. The number of English vessels employed in this trade are about 100, and of foreign vessels, generally about the same number.

To Germany.

The imports from Germany, as well as the exports from that country, are very numerous; the principal articles of the former are corn, flax, hemp, linens, rags, skins, wines, timber, &c.; of the exports, hardware, plated goods, salt, earthenware, tanned and wrought leather, gloves, hats, cotton and woollen goods, silk goods, watches, cabinetware, coaches, &c. besides colonial and East India produce to a large amount. The official value of the imports from Germany and the exports to it, has varied very much, at different periods of the war; and the average value of each, during the war, was much greater than before its commencement, as much of the trade between England and the continent was carried on through Germany. This will be sufficiently apparent from the following statement: In the year 1791, the official value of the imports from Germany was about L.600,000; of the exports, rather under L.2,000,000; whereas, in the year 1800, the imports were upwards of L.2,000,000, and the exports rather more than L.12,000,000. From this instance, which, however, it must be confessed, is an extraordinary one, the extreme difficulty may be conceived of giving any thing like an accurate statement of the average value of the exports and imports of England to and from any particular country, as they existed during the strange and unparalleled war from which we have just emerged; though there is no difficulty in giving an average statement of the whole amount of the imports and exports, from and to all parts of the world, during that war. The number of English vessels employed in the trade to Germany is generally about 200, and of foreign vessels rather more.

To Holland.

The principal articles of import from Holland are, geneva, cheese, butter, rags, flax, hemp, madder, clover and other seeds, corn, bacon, &c.; of export, cotton and woollen goods, hardware, sugar, coffee, and other articles of colonial and East India produce, frequently to a very large amount: the value of the imports is generally under L.1,000,000; of the exports, from L.1,500,000 to L.3,000,000. Before the commencement of the war, the number of English vessels engaged in this trade (including their repeated voyages), was nearly 900, of foreign vessels about 400.

To France.

The principal articles of import from France used to be articles of luxury, such as wines, brandy, lace, cambrics, lawns, silks, trinkets, &c.; of exports, cotton goods, hardware, cutlery, lead, tin, copper, besides a vast deal of East and West India produce. The official value of the imports from France during the year 1789, when the Revolution commenced, was rather more than L.500,000; and of the exports about L.1,200,000, of which about L.800,000 consisted of English manufactures, and the remainder of foreign produce. In the same year, the number of English vessels employed in this traffic (including their repeated voyages) was nearly 1400; and of foreign vessels about 250.

To Spain.

The chief articles imported from Spain are, barilla, oil, cochineal, fruits, wool, cork, dyewoods, wines, brandy, silk, &c.; of exports, hardware, earthen-ware, broad-cloths, leather, hats, baizes, &c. In time of peace, the official value of the imports was usually about L. 700,000, and the exports nearly the same; and the number of English vessels engaged in the trade about 200, and of foreign vessels about 50.

To Portugal.

The principal articles of import from Portugal are, brimstone, cork, drugs, and gums; wines, fruit, dye-stuffs, hides and skins, &c.; of exports, hardware, coals, glass, earthen-ware, woollen, cotton and silk manufactures, hats, and East and West India produce; the value of the imports is usually about L. 800,000; of the exports, rather more than L. 1,000,000: the number of English vessels employed, about 250; of foreign, about 50.

To Italy.

The usual articles of import from Italy, are barilla, brimstone, cork, oil, fruits, silk, &c.; of export, hardware, plated-ware, earthen-ware, woollen goods, cotton goods, pilchards, herrings, leather, and East and

West India produce. In time of peace, the official value of the imports was usually about L. 900,000, and of the exports nearly the same; and the number of English vessels engaged in the trade about 200; of foreign vessels, very few were employed.

To Turkey.

The imports from Turkey consist principally of carpets, drugs, dye-stuffs, fruits, silk, &c.; of exports, the principal are hardware, cotton and woollen goods, watches, and East and West India produce. The official value of the imports is about L. 200,000; of the exports nearly the same. The English and foreign vessels employed seldom exceed 20.

To Ireland.

The imports from Ireland to England are very numerous; they consist chiefly of corn, provisions, linen, hides, &c. The principal articles of export are coals, woollen, cotton, and silk manufactures; hats, haberdashery, earthenware, salt, glass, and East and West India produce. The value of the imports vary from L.2,000,000 to L.3,000,000; and the exports from L.3,000,000 to L.4,000,000, of which one half generally consists of foreign produce. The ships employed, (including, as usual, their repeated voyages,) are between 4000 and 5000.

To North America.

The principal articles of import from North America, are flour, provisions, masts, timber, cotton wool, tobacco, rice, tar, pitch, pot and pearl ashes, indigo, furs, &c.; of export, woollen and cotton goods to an immense amount, hardware, earthenware, books, hats, leather, linen, shoes, paper, &c. The value of the exports, especially those to the United States, has varied much latterly, according to the state of political relations between the two countries. It has been as high as L.12,000,000; the value of the imports is comparatively trifling. The vessels employed in times of peace are about 560, most of which are foreign.

To South America.

South America has lately become of great consequence to the English merchant and manufacturer; the emigration of the court of Portugal to the Brazils, and the circumstances which have occurred in the Spanish provinces, having opened the trade to this country. The principal imports from South America, are cotton-wool, skins, cochineal, logwood, indigo, Brazilwood, sugar, drugs, &c. The principal exports are, woollens, silk and cotton goods, linen, leather, hardware, hats, earthenware, &c. The value of the imports from the Brazils alone, amounted in 1810, to between L.2,000,000 and L.3,000,000; and about 160 ships were employed in the trade.

To the West Indies.

The principal articles of import from the West Indies are sugars, rum, coffee, pepper, ginger, indigo, drugs, cotton, &c. of export, hardware, provisions, woollen and cotton goods, hats, glass, earthenware, leather, shoes, ready made clothes, herrings, &c. The real value of the imports varies from L.8,000,000 to L.12,000,000; and of the exports from L.6,000,000 to L.12,000,000. The ships employed are about 600; the tonnage about 180,000; and the seamen about 15,000.

To the East Indies.

The principal articles of import from the East Indies, China, and Persia, are tea, spices, raw silk, muslins, nankeens, sugar, indigo, cloves and other spices, opium, quicksilver, drugs, gums, rice, saltpetre, &c. The principal articles of export are woollen goods, tin, hardware, lead, copper, bullion, clocks, watches, hats, millinery, coaches, cabinet and upholstery goods, &c.

From the year 1708 to 1811, there was exported to India bullion to the value of L.29,583,210; and merchandise to the value of L.35,528,886; making the total exports to India, during that period, L.65,112,096; and during the same period, there was exported to China, bullion of the value of L.13,295,092; and merchandise to the value of L.24,012,656; making the total value of the exports to China L.37,307,748; and the total value of the exports both to India and China, from 1788 to 1811, L.102,419,844. On an average of 1811, 1812, and 1813, the goods exported to India and China, amounted to L.1,900,000; and on an average of the same years, the total produce of the articles sold at the East India Company's sales amounted to about L.6,000,000.

In the year 1771, the tonnage employed in this trade was 61,000; by an act passed in the year 1772, the company was restrained from building, till their shipping was reduced to 45,000 tons: this reduction took place in 1776, when they began to rebuild. In 1792, their English built ships amounted to nearly 80,000 tons: at present the tonnage is upwards of 100,000; the burden of the ships varying from 500 to 1500 tons.

This trade has hitherto been wholly vested in the hands of the East India Company; but on the expiration of their present charter, the trade to the East Indies will be thrown open, under certain regulations: that to China will still continue the monopoly of the company.

Such is a brief, and necessarily an imperfect, abstract of the principal branches of English commerce. In consequence of the political relations in which this country has stood for the last twenty years with the continent of Europe, and for the last eight years with the United States of America, it is not possible to present a fair average statement of its regular trade, either with Europe or America. The following official statements, however, will serve to give us a clearer insight into the real value of the exports.

Exports.

Real value of exports, on an average of three years ending 1807, to the continent of Europe, L.17,801,232: to Ireland, Guernsey, &c. L 6,415,428; to Asia, L.3,308,991; to Africa, L.1,278,248; to the United States of America, L.12,136,811; to other parts of America, and the West Indies L.10,599,514; making a total, on the annual average of three years ending 1807, of L.51,540,224; if from this sum we deduct L.4,000,000 as the value of the exports from Scotland, it will leave about L.47,000,000 as the value of the exports from England.

Real value of exports, on an annual average of four years, ending 1811, to the continent of Europe, L.20,983,808; to Ireland, &c. L.7,128,364; to Asia, L.3,222,575; to Africa, L.725,013; to the United States, L.6,464,059; and to the other parts of America and the West Indies, L.17,133,553; making a total of L.55,657,372; from which, deducting L.4,657,372, as the probable amount of the exports from Scotland, there will remain L.51,000,000 as the amount of the exports from England. This comparative statement of the exports of two series of years, will be sufficient to shew how much the value of our exports varied both to the continent of Europe and to the United States, particularly to the latter.

Imports.

The following statement shews the real value of the imports into England alone, (exclusive of those from India and China,) and of the exports from England, distinguishing foreign from English produce exported. In the year ending 10th October 1806, there were imported articles to the value of L.38,398,645; and exported of foreign goods, L.9,005,120; and of English goods, L.39,368,218. In the year ending the 10th of October 1807, there was imported, L.40,947,300; exported of foreign goods, L.9,679,652; and of English goods, L.39,041,854. And in the year ending

10th of October 1810, the imports were L.34,448,620; the foreign exports, L.7,138,282; and the English exports, L.32,233,477. Of this immense trade, London alone possesses nearly two-thirds. Liverpool, Bristol, Hull, Newcastle, Sunderland, and Whitehaven, rank next to London in commerce.

The following statement may also be given, as exhibiting a clear and satisfactory view of the increase in the *official* value of the imports and exports of England, during the last 100 years:

Years.	Imports.	Exports.
1719	L.5,367,499	L.6,834,716
1729	7,540,620	8,239,924
1739	7,829,373	8,843,624
1749	7,917,804	12,678,758
1759	8,922,976	13,947,788
1769	11,908,560	13,438,236
1779	10,762,240	12,352,052
1789	16,408,040	17,989,395
1799	24,483,841	31,723,727
1809	27,142,541	45,918,663

Shipping.

It may well be conceived, that the total amount of the tonnage, employed in the domestic and foreign trade of England, is very great. In the year 1800, there were 12,198 vessels belonging to English ports; of the burden of 1,466,632 tons; and navigated by 105,037 men and boys. In the month of September 1813, there were belonging to the English ports 16,602 vessels; of the burden of 2,029,637 tons; and navigated by 127,740 men and boys. In consequence of the fire at the Custom-house, the English and foreign ships that entered inwards, and cleared outwards, for the year 1813, cannot be calculated; but in 1812, there entered inwards, (including their repeated voyages,) of English ships, 10,756 of the burden of 1,310,156 tons, navigated by 78,269 men and boys; and of foreign ships 2246, of the burden of 469,696 tons, navigated by 22,829 seamen; and in the same year, there cleared outwards, (including their repeated voyages,) of English ships, 11,177, of the burden of 1,386,550, and navigated by 85,473 seamen; and of foreign ships 2336, of the burden of 490,206 tons, and navigated by 24,949 seamen. About one-sixth part of the whole English shipping belongs to the port of London.

Circulating medium.

The circulating medium of England consisted of the precious metals, and of bank notes, convertible at pleasure into the precious metals, until the year 1797, when, in consequence of a great run on the Bank of England, (the only chartered bank in the country,) an act of parliament was passed, freeing the bank from the obligation of paying coin for their notes.

The money coined in the reign of Charles II. amounted to L.7,524,105; in that of James to L.2,737,637; by William to L.10,511,963; by Anne to L.2,691,626; by George I. to L.8,725,921; by George II. to L.11,966,576; and by George III. down to the year 1800, to L.62,945,863. Since the year 1800, very little has been coined; and, at present, the circulating medium consists almost entirely of the notes of the Bank of England, and of the provincial banks.

The amount of the value of the Bank of England notes in circulation, in the year 1718, was L.1,829,930; in the year 1761, L.5,863,290, besides post bills to the value of L.138,520; in the year 1791, they had reached the sum of L.11,699,000; but, in February 1797, they were reduced to L.8,640,000; in 1802, they were L.17,054,450; and, at present, they are upwards of L.29,000,000.

The natural and obvious consequence of the withdrawing of the metallic currency of the kingdom, was not only an increase in the amount of Bank of England notes, but also an increase in the number of provincial banks, and in the amount of the value of their notes. In the year 1797, the number of country banks, issuing notes in England, did not reach 200; in 1808, they were nearly 600; in 1811, 649; in 1812, 625; in 1813, 643; and in 1814, 689. The average circulation of each of which cannot possibly be rated at less than L.30,000, which will make the total amount of the circulation of the provincial notes upwards of L.20,000,000; but it is probably much greater.

Even this circulating medium, great as it is, would be totally inadequate of itself to carry on the immense trade of this kingdom. In London, the great seat of mercantile transactions, exchanges to a very large amount are effected, without the intervention of any circulating medium, by means of brokers, who buy and sell for different merchants, and set off the various articles against each other. As a proof how small a sum of circulating medium is employed to transact business to a very large amount in the metropolis, it may be mentioned, that in the clearing house, in Lombard Street, where the clerks of the different banking houses meet for the purpose of exchanging drafts, drafts to the amount of upwards of L.4,000,000 are frequently presented in the course of the day, while bank notes only to the amount of about L.200,000 are required to pay the balance.

Finance.

The principal sources of the revenue of England are the duties of customs and excise; the stamp-duties; the land-tax, and assessed taxes; the post-office duties; and the income tax. The revenue is divided into the permanent taxes, and the war taxes; the latter, laid on during the revolutionary wars with France, consist of the income-tax, and of additional duties of customs and excise.

Customs.

About the commencement of the 17th century, the produce of the customs amounted to nearly L.150,000, of which upwards of L.100,000 was collected in the port of London. In the act of union, the customs of Scotland are reckoned at L.30,000, and those of England at L.1,341,559. In the year 1800, the gross produce of the customs of England was L.8,551,668; in the year 1804, L.10,189,238; in the year 1810, the permanent revenue of the customs was L.9,952,835; and the temporary, or war custom duties, amounted to L.3,599,215; making a total of L.13,552,050; and in the year 1813, the gross produce of the permanent duties of customs was L.9,367,542; and the war duties, L.3,523,205; making a total of L.12,890,747. The revenue of the customs is collected in England at the rate of L.5, 1s. 2d. on the gross amount.[*]

Excise.

The Excise, which consists of inland duties, or taxes on articles manufactured or consumed, originated in the year 1626; but was not actually established till the year 1643. In the reign of George I. the excise duties were rendered perpetual. In the year 1800, the gross produce of this branch of the revenue amounted to L.11,994,199; in the year 1804, to L.20,985,644; in the year 1810, the permanent duties of excise amounted to L.18,925,954; and the war duties to L.6,488,870; making a total of L.25,414,824. For the year 1813, the following Table exhibits the particulars of the excise duties:

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[*] The particulars of the custom receipts for 1813, could not be made out, in consequence of the fire at the Custom-house, which destroyed all the documents.

Statistics.

Account of the gross actual receipt in Money, and net produce of the Excise Consolidated Duties, Unconsolidated Duties, Temporary War Taxes, and Tobacco and Malts, annual, in England, for the Year ending 5th January 1814.

Statistics.

Articles.	Gross actual receipt in money.	Net produce of each article.
Auctions	L. 343,530 16 8¾	L. 335,184 4 1¼
Beer	2,888,298 13 10¼	2,569,272 3 3½
Bricks and Tiles	300,184 8 10½	293,249 9 2¼
Candles	311,305 15 6½	250,637 6 10¾
Cocoa Nuts and Coffee	124,019 7 2¼	115,655 12 1¼
Cider, Perry, and Verjuice	25,197 17 8	20,996 4 10½
Glass	614,054 14 8¼	383,531 6 5½
Hides and Skins	674,751 3 8¼	592,669 0 3
Hops	53,537 2 1	36,061 19 2¾
Licences	439,892 15 0½	433,750 5 4¼
Malt	1,120,558 12 10	1,119,461 11 9¾
Paper	419,570 17 3¼	372,976 10 11¾
Printed Goods	947,029 1 3	322,145 19 0
Salt	1,548,092 14 5¾	1,394,253 10 10
Soap	643,039 16 7½	551,468 12 9¼
Spirits { British	1,636,523 17 1¼	1,620,883 6 3
Spirits { Foreign	1,499,110 8 8¼	1,423,359 11 5½
Starch	37,422 6 0¼	29,178 8 5
Stone Bottles	2,538 3 5¾	2,279 18 2½
Sweets and Mead	25,453 6 9	25,337 10 3
Tea	2,048,096 0 0½	1,914,739 17 7½
Tobacco and Snuff	383,870 9 6	382,001 5 5¼
Vinegar	42,593 16 2¾	42,155 2 6
Wine	1,100,583 12 3¾	980,652 17 11½
Wire	12,887 18 4½	11,537 10 4½
Total Consolidated Duties	**L.17,242,153 16 3½**	**L.15,223,429 5 7½**
Spirits { British, per 51 Geo. III. ch. 59.	L. 5,202 3 3	L. 5,129 4 9
Spirits { Foreign, Do.	23,182 7 0¼	28,174 14 7¼
Total unconsolidated Duties	**L. 33,384 10 3¼**	**L. 33,303 19 4½**
TEMPORARY WAR TAXES.		
Malt, per 43 Geo. III. ch. 81.	L. 2,205,229 10 7	L. 2,187,270 1 2½
Sweets .... Do.	4,220 2 4¾	4,219 11 4¾
Spirits { British, Do.	580,612 6 4	580,465 11 10
Spirits { Foreign Do.	742,262 2 3¼	742,111 10 1¾
Tea	2,055,263 18 8	1,960,299 17 11¾
Tobacco and Snuff, per 46 Geo. III. ch. 39.	312,534 3 6	310,566 17 6¾
Brandy, &c. { per 47 Geo. III. ch. 27.	53,166 14 2¾	58,050 16 11¾
Brandy, &c. { 52 Geo. III. ch. 8.	7,821 7 3¼	7,820 1 4¾
Total Temporary War Taxes	**L. 5,966,110 5 3**	**L. 5,850,804 8 6**
ANNUAL DUTIES.		
Tobacco & Snuff, commissioned 26th March	L. 483,081 9 1	L. 453,262 6 3¼
Malt, Additional, Do.	893,592 8 9¾	893,158 16 7¼
Malt, Old, commis. 24th June	552,951 11 2¾	423,808 15 8¾
Total Annual Duties	**L. 1,929,625 9 1½**	**L. 1,770,229 18 7¼**
TOTALS COLLECTED.		
Consolidated Duties	L.17,242,153 16 3½	L.15,223,429 5 7½
Unconsolidated Do.	33,384 10 3¼	33,303 19 4½
Temporary War Taxes	5,966,110 5 3	5,850,804 8 6
Annual Duties	1,929,625 9 1½	1,770,229 18 7¼
Grand Total	**L.25,171,274 0 11¼**	**L.22,877,767 12 1**

Statistics. Stamps. The expence of collecting the excise duties is at the rate of L.2 : 11 : 10 per cent on the gross amount.

The gross produce of the stamp duties, in the year 1800, amounted to L.2,698,365; in 1804, to L.3,429,697; and, in 1810, to L.5,311,269. The following Table exhibits the particulars of the Stamp Duties for 1813:

Duties.	Gross Produce.	Net Produce.
Deeds, Law Proceedings, and other written instruments, (except Legacy Receipts, &c.), and Licences to Pawnbrokers, &c.	L.2,010,598 13 5¾	L.1,901,235 9 0
Legacies	545,115 6 3	525,134 17 2
Probates and Administrations	417,263 5 2	402,576 0 3¼
Bills of Exchange and Promissory Notes	624,353 17 5	602,542 9 5
Receipts	161,080 9 3	148,827 0 2¾
Newspapers and Almanacks	394,041 0 4	329,069 17 1
Medicine and Medicine Licenses	41,578 11 3½	36,188 11 7½
Fire Insurances	437,380 18 6	405,844 2 1½
Cards	24,462 5 0	23,788 9 1
Gold and Silver Plate	66,198 9 4½	60,030 15 6¾
Dice	723 0 0	712 8 6
Pamphlets	415 13 8	410 0 10
Advertisements	114,111 12 10	110,348 9 9½
Stage Coaches	167,239 17 0¼	163,010 6 11¾
Post Horses	247,467 10 0	244,322 12 2
Race Horses	868 7 0	786 16 10½
	L.5,252,898 16 7½	L.4,954,828 8 5½

The rate at which the gross revenue of the Stamps is collected, is L. 8 : 1 : 9 per cent.

Land-tax. The land-tax, which at first was an annual tax, was made perpetual in the year 1799, and offered for sale to the proprietors of the land, or to any other persons who chose to purchase it. In the course of the first year after this act, upwards of L. 13,000,000 was purchased; and on the 23d of February 1813, rather more than one-third was redeemed. In 1813, the gross produce of the land-tax was L.1,272,256: the net produce L. 1,127,078.

Assessed taxes. The assessed taxes consist principally of the house and window taxes. In the year 1800, these together, with the land-tax, amounted to L. 4,451,900: in 1804, to L.5,747,374: and in the year 1810, to L.7,210,384. In the year 1813, the assessed taxes, independently of the land-tax, amounted to L.6,155,867 gross; and to L. 5,903,818 net: the rate at which the gross revenue of the land and assessed taxes is collected, is L.4 : 5 : 8 per cent.

Post Office. The present establishment of the Post Office was traced in outline in 1642; but there was no regular Post Office till 1654. In the year 1724, the revenue from this source amounted only to the sum of L.96,332: the plan of conveying letters by the mail coaches, was begun in 1784, the revenue the year before amounting to L. 159,000. In the year 1800, the gross produce of the Post Office was L.999,354: in 1804, L.1,178,408: and in 1810, L.1,574,543. In the year 1813, the gross produce of the inland post was L.1,532,980: of the foreign post, L. 128,647; and of the twopenny post L. 93,299; making a total of L. 1,754,926: the net produce was L. 1,236,148: the revenue is collected at the rate of L. 25 : 9 : 4 per cent. on the gross receipts.

Property tax. The income or property tax is 10 per cent. on all incomes, (with some exceptions and modifications); in the year 1800, when it was only 5 per cent. it amounted to L.4,677,766: in 1804, to L. 8,572,556: in 1810, when it was 10 per cent. it amounted to the sum of L.12,514,369: and in 1813, the gross produce of it was L.13,016,041. Of the following Tables, the first exhibits the amount of the income of England and Wales, in the years 1806, 1808, and 1810, derived from all the different sources, except the public funds, public offices, &c. on which the income tax was levied; and the second, the amount of income in 1810, derived from trades and professions, shewing the particular sums derived from every rate of income, from L.50 to L.5000 and upwards.

	1806.	1808.	1810.
Profits from Lands	L.25,908,206 16 9¼	L.27,368,469 14 8¼	L.29,503,073 18 11¼
——— from Houses	11,201,950 9 3¾	12,029,799 8 1	13,010,546 18 4
Amount of Tithes	2,012,064 4 4½	2,139,942 5 11¼	2,353,249 13 7½
Profits from Manors	43,521 6 11	53,959 11 1	64,372 13 4
Amount of Fines	70,165 14 0¼	109,761 6 11	154,841 4 3
Profits of Quarries	18,646 0 9	24,642 17 4	29,160 6 11
——— Mines	316,483 16 11	428,288 18 11	483,490 19 8
——— Iron Works	77,434 17 1	129,910 17 6	222,672 16 11
General Profits	248,967 11 1¾	182,390 15 6	55,040 17 4
	L.39,897,440 17 8½	L.42,467,165 15 11½	L.45,876,449 9 3¾
Profits from Professions and Trades	32,763,640 5 5¾	31,389,789 7 9	32,210,599 11 10½

L. 50 and under		L. 2,315,870	15	10
above 50	100	6,295,760	1	11
100	150	3,012,507	5	1
150	200	1,704,409	10	0
200	300	2,166,129	10	8
300	400	1,567,386	2	0
400	500	1,157,616	6	1
500	600	1,037,126	4	11
600	700	745,595	7	1
700	800	518,938	14	11
800	900	565,614	15	7
900	1000	295,575	10	4
1000	1500	1,732,025	13	10
1500	2000	1,057,076	4	2
2000	3000	1,407,242	19	10
3000	5000	2,017,147	16	6
5000 and upwards		4,614,576	13	1½
Total assessed		L. 32,210,599	11	10½

The following particulars, strictly speaking, relate to the finances of Great Britain; but as the revenue derived from Scotland is comparatively very trifling, and as it is impossible to ascertain what proportion of the expenditure belongs to that country, and what to England, it is thought proper to give them under the present article.

Revenue in 1813.

Total revenue of Great Britain for the year 1813, L.79,448,111: Loans paid into the Exchequer, including six millions for Ireland, L.35,050,574. Exchequer bills issued between 5th January 1813, and 5th January 1814, and not redeemed within that period, L. 41,354,000: Navy, victualling, and transport bills issued, L.3,699,740. Total income of the consolidated fund, (which consists principally of the customs, excise, stamps, assessed taxes, &c.) as it stood 5th January 1814, L. 41,827,304: Total charge upon it, L. 41,555,752. Net produce of the permanent taxes of Great Britain, in the year 1813, L.37,597,835; in the year 1814, L. 38,893,027.

Expenditure.

The following statement shews the particulars of the expenditure of Great Britain for 1813, and also the state of the national debt in February 1814. For further particulars respecting the national debt, see DEBT, *National.*

Expenditure, 1813.

Interest on debt	L. 24,055,665	16	0¾
Charges of management	238,827	17	7
Reduction of national debt	15,521,352	13	4
Interest on exchequer bills	2,081,529	10	6
Civil list	1,028,000	0	0
Courts of justice, mint, &c.	1,595,350	6	11¾
Civil government of Scotland	113,176	4	8¼
Bounties for fisheries, manufactures, and commerce	228,741	18	7
Pensions on the hereditary revenue	27,700	0	0
Militia and deserters warrants	134,614	3	4¾
Navy	11,372,513	4	11
Victualling service	6,568,320	11	6½
Transports	3,565,790	12	11
Miscellaneous	490,000	0	0
Ordnance	5,368,108	12	6
Army	18,500,985	11	0
Extraordinary services and subsidies	22,262,951	0	0
Miscellaneous services	4,005,824	18	4½
Loan to Ireland	4,700,416	13	4
Expence on exchequer bills	4,525	0	0
	L. 118,872,813	15	1½

Funded Debt.

	February 1814.		
Total amount of debt of Great Britain	L.727,339,121	5	11¾
Total amount of debt of Ireland payable in Great Britain	79,130,250	0	0
Total amount of debt of Germany payable in Great Britain	7,502,633	6	8
Total amount of debt of Portugal payable in Great Britain	895,522	7	9
	L. 814,867,527	0	4¾
In the hands of commissioners for reduction of the debt	94,996,304	0	0
	L. 719,871,223	0	4¾
Transferred to commissioners by purchase of life annuities	2,361,667	0	0
	L. 717,509,556	0	4¾

Total charge for debt payable in Great Britain, L. 39,337,216 : 3 : 8¼.

Unfunded debt and demands outstanding, 5th January 1814, L. 60,968,966 : 11 : 11¾.

Ways and means voted 1813	L. 68,106,308	0	0
Services	71,976,641	8	3
Deficiency of ways and means	L. 3,870,333	8	3

Navy.

The Navy of Great Britain forms its principal bulwark and pride; and its increase and present strength are not more astonishing, than the increase and present amount of the wealth of the kingdom, which we have just exhibited. At the death of Queen Elizabeth, the total number of ships belonging to the navy was 42, the largest mounting 40 guns, and the whole navigated by 8376 men. At the death of King William, the total number of ships was 256, of which 123 were of the line. At the death of George II. it had not increased much, there being only 136 ships of the line. At the commencement of the war in 1793, there were 156 sail of the line: in January 1801, 195 sail of the line: and in the month of April 1814, there were in commission 727 ships of war; of which, 157 were of the line, 24 from 50 to 44 guns, 145 frigates, 124 sloops of war, 8 bombs and fire ships, 184 armed brigs, 39 cutters, and 49 schooners; besides which, there were in ordinary, repairing, and building, a number, making the total 1022, and the ships of the line 250. The seamen and marines employed at this time amounted to 140,000.

Army.

Till the war which has just terminated, the generals and soldiers of Great Britain certainly did not bear so high a character as her seamen, but their exploits during that war has raised them to an equality; and the exertions of this country in increasing her troops, far surpassed those she had put forth at any former period. In the year 1775, the whole regular troops amounted only to 33,190; in 1783, to 90,395; in 1793, to 38,945; and in 1801, to 149,865: all these, however, except the last, were periods of peace. At the termination of the present war, Great Britain maintained upwards of 28,000 cavalry, 7500 foot guards, 191,000 infantry, and 71,000 militia. The English militia amounted to upwards of 51,000: besides these, there were the local militia, volunteer corps, foreign troops, artillery, &c.

Statistics.

Population.

The population of England and Wales was long a subject of great uncertainty, till it was at last determined by the result of an act of parliament in December 1800, which directed a general enumeration of houses, families, and persons. From this enumeration it appeared, that there were in England 1,472,870 inhabited houses, occupied by 1,787,520 families; and that the total number of persons was 8,331,434: While in Wales there were 108,053 inhabited houses, occupied by 118,303 families; and that the total number of persons was 541,546. In the year 1811, a similar enumeration took place, of which the following are the results:

Inhabited houses in England	1,678,106
. . . . in Wales	119,398
Number of families in England	2,012,391
. . . . in Wales	129,756
Houses building in England	15,188
. . . . in Wales	1,019
Uninhabited houses in England	47,925
. . . . in Wales	3,095
Families engaged in agriculture in England	697,353
. . . . in Wales .	36,044
Families engaged in trade in England . . .	923,578
. . . . in Wales	36,044
Families engaged in other occupations in England	391,450
Families engaged in other occupations in Wales	20,866
Males in England	4,575,763
. . . . in Wales	295,633
Females in England	4,963,064
. . . . . in Wales	320,155
Total inhabitants of England	9,538,827
. . . . in Wales	611,788

From a comparison of the population of England in the years 1801 and 1811, it appears that it had increased 14½ per cent. during that period; while the population of Wales had increased 13 per cent. The population of the manufacturing districts had increased in much the greatest proportion; in 1801, the population of Lancashire was 672,731; in 1811, it was 856,000. In 1801, the population of the west riding of Yorkshire was 563,953; in 1811, it was 675,100. There is also reason to believe, that the population of England and Wales, between 1785 and 1795, increased nearly in the same proportion as it did between 1801 and 1811. The proportion of sexes was much the same in 1811 as in 1801, that is, about 10 males to 11 females of the resident population. The following Table exhibits the increase between 1801 and 1811, in a more particular point of view:

	POPULATION, 1801.				POPULATION, 1811.		
	Males.	Females.	Total.	Increase.	Males.	Females.	Total.
England	3,987,935	4,343,499	8,331,434	1,207,393	4,575,763	4,963,064	9,538,827
Wales	257,178	284,368	541,546	70,242	291,633	320,155	611,788
Army and Navy .	470,598	. . . . . .	470,598	169.902	640,500	. . . . . .	640,500
Totals . . .	4,715,711	4,627,867	9,343,578	1,447,537	5,507,893	5,283,219	10,791,107

Till the enumerations of 1801 and 1811, it was generally supposed, that there were not more than 5½ persons to a house in London, and the other great towns; but the result of these enumerations proves, that, taking the whole of England and Wales, the proportion of inhabitants to a house is about 5⅕, while in the towns it varies very considerably, from 4¾ to 9½.

Although there are no certain data, by means of which the population of England and Wales can be accurately ascertained, previous to the enumeration of 1801, yet the following Table, constructed on the best information regarding this subject, it is presumed, exhibits pretty nearly the state of the population, at different times, prior to 1801:

Years.	Population.
1700	5,475,000
1710	5,240,000
1720	5,565,000
1730	5,796,000
1740	6,064,000
1750	6,467,000
1760	6,736,000
1770	7,428,000
1780	7,953,000
1785	8,016,000
1790	8,675,000
1795	9,055,000

The following Table exhibits the baptisms, burials, and marriages at different periods, from 1700 to 1810:

Years.	Baptisms.	Burials.	Marriages.
1700	157,307	137,305	. . . .
1710	143,735	145,146	. . . .
1720	159,906	165,956	. . . .
1730	166,514	182,579	. . . .
1740	174,237	172,731	. . . .
1750	185,816	160,020	. . . .
1760	192,914	161,004	57,848
1770	213,427	180,396	62,693
1780	228,361	198,348	64,309
1790	256,548	184,894	70,648
1800	254,870	208,063	69,851
1801	237,029	204,434	67,228
1802	273,837	199,889	90,396
1803	294,108	203,728	94,379
1804	294,592	181,177	85,738
1805	292,201	181,240	79,856
1806	291,929	183,452	80,754
1807	300,294	195,851	83,923
1808	296,074	200,763	82,248
1809	299,989	191,471	83,369
1810	298,853	208,184	84,470

Burials.

The average number of *registered* burials was stationary for 21 years, from 1780 to 1800; the average number being about 192,000 per annum. From 1800 to 1805, the average was 194,000; and from 1805 to 1810, the average number was 196,000.

Statistics.

In 1780, 1 in 40 died annually.
In 1790, 1 in 45.
In 1800, 1 in 47.
In 1810, 1 in 49 or 50.

Marriages.

The next Table shews the number of marriages, on a medium average of 5 years, and also on a medium average of 10 years, from the passing of the marriage act to the year 1810:

Years.		Medium average of five years.	Medium average of ten years.
1755 to 1760	inclusive,	52,666	56,275
1760 to 1765	do.	59,883	
1765 to 1770	do.	59,043	59,892
1770 to 1775	do.	60,741	
1775 to 1780	do.	64,238	65,479
1780 to 1785	do.	66,722	
1785 to 1790	do.	71,363	71,784
1790 to 1795	do.	72,205	
1795 to 1800	do.	74,998	79,231
1800 to 1805	do.	83,465	
1805 to 1810	do.	82,953	

In the following Table, the number of baptisms to 100 marriages, at different periods, from 1760 to 1810, is given:

Years.	Baptisms.		Marriages.
In 1760	366	to	100
1770	361	to	100
1780	356	to	100
1785	366	to	100
1790	359	to	100
1795	353	to	100
1800	340	to	100
1805	350	to	100
1810	360	to	100

The last Table we shall give on this subject exhibits the population of each county; the area of each county in square miles; the number of people in each county to a square mile; and the annual proportions in each county, of baptisms, burials, and marriages:

Counties.	Population in 1811.	Area in square miles.	Number of people to a square mile.	Annual Proportions.		
				One baptism to persons.	One burial to persons.	One marriage to persons.
Bedford	72,600	430	171	32	56	126
Berks	122,380	744	164	34	53	144
Bucks	121,600	748	162	33	49	129
Cambridgeshire	104,500	686	152	30	44	127
Chester	234,600	1,017	230	33	50	131
Cornwall	233,900	1,407	158	32	62	141
Cumberland	138,300	1,497	92	35	54	138
Derby	191,700	1,077	178	33	56	137
Devon	396,100	2,488	159	33	52	113
Dorset	128,900	1,129	114	35	57	135
Durham	183,600	1,040	176	33	50	128
Essex	260,900	1,525	171	33	44	128
Gloucester	295,100	1,122	263	36	61	120
Hereford	97,300	971	100	36	58	150
Hertford	115,400	602	190	34	55	163
Huntingdon	43,700	345	126	31	48	129
Kent	385,600	1,462	263	30	41	118
Lancashire	856,000	1,806	473	29	48	108
Leicester	155,000	816	190	36	57	130
Lincoln	245,900	2,787	88	32	51	126
Middlesex	985,100	297	3316	40	36	94
Monmouth	64,200	516	124	47	64	153
Norfolk	301,800	2,013	150	30	50	128
Northampton	146,100	965	150	35	52	133
Northumberland	177,900	1,809	98	37	53	137
Nottingham	168,400	774	217	32	52	119
Oxford	125,200	742	168	34	55	138
Rutland	17,000	200	85	32	53	147
Salop	200,800	1,403	143	36	57	143
Somerset	313,300	1,549	200	35	52	129
Southampton	253,300	1,533	165	31	49	106
Stafford	304,000	1,196	254	32	52	121
Suffolk	242,900	1,566	155	31	53	128
Surrey	334,700	811	412	36	45	130
Sussex	196,500	1,461	134	30	55	129
Warwick	236,400	984	240	35	42	116
Westmoreland	47,500	722	65	31	54	135
Wilts	200,300	1,283	156	35	54	136
Worcester	165,900	674	244	32	52	132
York, East	173,000	1,268	136	30	47	105
North	157,600	2,112	74	30	51	125
West	675,100	2,633	256	31	51	123
England	9,855,400	50,210	196	33	49	120
Wales	632,600	8,125	77	37	60	136
	10,488,000	58,335	179	34	50	122

tate of the oor.

In treating of the population of England, it would be improper not to notice the state of the poor, and the mode by which they are supported; and yet our limits compel us to be very brief on this subject. By the 43d of Elisabeth, chap. 2. every parish is bound to provide for its own poor; and authority was given to justices of the peace, &c. to rate every parish at such a weekly sum of money, as they should think necessary for this purpose. In 1776, a return was made to parliament of the total expenditure for one year, on account of the poor, from which it appeared, that the sum expended was L.1,530,804; and that there were 1970 work-houses capable of accommodating 89,775 persons. In 1786, another return was made, from which it appeared, that the expenditure for the poor had increased to L.2,004,238. In the year 1803, a very detailed return was again made, from which the following particulars appeared: The number of persons maintained in work-houses was 83,468; the expence incurred, L.1,016,445; the number of persons relieved out of work-houses was 956,248, besides 194,052, who were not parishioners; the expence incurred for them was L.3,061,446. The number of persons relieved in and out of work-houses was 1,039,716, which was about 12 per cent. of the resident population. The total sum raised by the poor's rate, and other parochial rates within the year, ending Easter 1803, was L.5,348,205. The average rate in the pound was, in England, 4s. 4½d.; in Wales, 7s. 1½d.; and the average of England and Wales, 4s. 5¼d. No return has been made since the year 1803; but the amount of the poor's rate at present cannot be much less than L.8,000,000.

CHAP. XI.

Constitution, Government, and Laws, Civil and Religious.

Origin of Parliament.

The English government is distinguished from that of other nations, principally by this circumstance, that in it the right of making and that of enforcing the laws, or the legislative and executive powers, are distinct and separate. The legislative authority is vested, by the constitution of the kingdom, in the Parliament, which consists of King, Lords, and Commons. It is not accurately and satisfactorily ascertained, at what precise period the Parliament, as it is now constituted, was formed; that is, when the Commons first began to compose a distinct assembly from the Lords; but the generally received opinion is, that the Parliament was, on the whole, much the same as it now is, so long ago as the 17th year of King John, A. D. 1215.

Mode of summoning.

With respect to the manner and time of the assembling of Parliament, it is usually and regularly summoned by the King's writ and letters, issued by the advice of the privy-council, at least 40 days before it begins to sit. The Parliament cannot meet of its own authority, it being a part of the royal prerogative to convene it at such time and place as the King shall deem proper. If there should be no Parliament in being at the death of the King, the last Parliament revives, and is to sit again for six months, unless his successor shall dissolve it.

Constituent parts.

The constituent parts of Parliament, as has been already remarked, are the King and the Three Estates (as they are denominated) of the realm, the lords spiritual, the lords temporal, and the commons. The king and the lords spiritual and temporal sit in one house, which is called the House of Lords; and the representatives of the people in another, which is called the House of Commons. When Parliament assembles at the beginning of a session, the king always meets them in person, or by commissioners appointed to represent him. He also has the power to prorogue or dissolve it. Besides these royal prerogatives, as they respect Parliament, the king possesses the privilege of rejecting any bill that may have passed both Houses, and consequently preventing it from being enacted into a law.

Lords spiritual.

The lords spiritual, as a constituent part of Parliament, consist of the two archbishops and 24 bishops of England, and four bishops of Ireland. The English archbishops and bishops sit in the Upper House, from their holding, or being supposed to hold, certain baronies under the king.

Lords temporal.

The lords temporal consist of all the peers of the realm, in their several degrees of duke, marquis, earl, viscount, and baron. The duke is so styled from the Latin, *Dux*, a leader or general. The title of marquis is derived from the Gothic, and signifies the commander or guardian of a march or frontier. The titles of earl and baron are also from the Gothic, and signify simply eminent men. Viscount is derived from the Latin, and signifies the lieutenant of the count or earl. The bishops are not, strictly speaking, peers of the realm, but only lords of Parliament. The number of the lords temporal is indefinite, the king possessing the privilege of increasing them at his pleasure. Some sit in the Upper House by descent; some by creation; the Scotch and Irish peers by election.

House of Commons.

The House of Commons consists of knights, citizens, and burgesses, respectively chosen by counties, cities, and boroughs. The number of representatives sent to Parliament, for England, Wales, and the town of Berwick, is 513. The Scotch and Irish representatives increase the number to 658 members. No person can vote for a knight of the shire, unless he possess a freehold estate of the annual value of 40s. Neither beneficial leases for a term of years, nor copyhold estates, give the right of voting. A leasehold, however, vested in an individual for life, does. Every candidate for the representation of a county, must have a clear estate of freehold, or copyhold, of the value of L.600 per annum, unless he be the eldest son of a peer, or a person qualified as a knight of the shire.

The citizens and burgesses in Parliament are the representatives of the mercantile and trading interests, as the knights of the shire are of the landed property. Many boroughs, however, with no trade, and some with very few persons entitled to vote, return members to Parliament, while some of the most populous and flourishing places in England, as Manchester and Birmingham, send no representatives. The right of electors in boroughs varies according to the charters, customs, and constitutions of the respective places. Every candidate to represent a city or borough, must possess a free estate, of freehold or copyhold, to the value of L.300 per annum, unless, as in the case of candidates for counties, he be the eldest son of a peer, or of a person qualified as a knight of the shire.

Mode of electing.

As soon as the Parliament is summoned, the lord chancellor sends his warrant to the clerk of the crown in Chancery, who then issues out writs to the sheriffs of every county, for the election of all members to serve for that county, and for every city and borough in it, which possesses the privilege of returning members to Parliament. But in case a vacancy for any place occur while Parliament is sitting, the speaker of the House of Commons issues his warrant for the election of a new member. As soon as the place and time of election are fixed, all soldiers must be removed to the distance of two miles or more, and must not return till the poll is over. No lord of Parliament, or lord-lieutenant of a county, has any right to interfere at elections. When a poll is demanded, it must commence immediately, and be continued from day to day, for at least seven hours each day, till it be finished. The sheriff, or returning officer, has the right of granting a scrutiny, if it be demanded. The persons returned are the sitting members, until the House of Commons, upon petition, shall adjudge the return to be illegal. All petitions against sitting members are referred to a select committee of 15 members of the House of Commons.

Mode of vacating a seat.

On the first day of the meeting of every new Parliament, the lord steward of his Majesty's household administers the necessary and usual oath to the members present; and then executes a commission, empowering certain members to administer the same oath to others. Every member is obliged to attend his duty in the House, unless he can shew a sufficient excuse for his non-attendance; if he do not, he is ordered into the custody of the serjeant-at-arms, which is attended with the expence to the party of about L.5 a day. No member can vacate his seat, unless he accept of an office under the crown. The offices of stewards of the chiltern hundreds (from which neither honour nor profit are derived) are generally accepted for that purpose. As soon as the seat in Parliament is thus vacated, these offices are resigned, and are then ready for any other members, who wish to vacate their seats. Commissioners for prizes, agents for regiments, officers of the excise and customs, clerks of the treasury, &c. and every person who holds any office under the crown, created since 1705, or any pension during the pleasure of the king, or for any term of years, are ineligible to sit in Parliament.

Power of Parliament.

The Parliament thus constituted, consisting of King, Lords, and Commons, is invested with absolute power. Besides the power of making and repealing all laws, it can new-model the succession to the crown; alter the established religion of the land; and even change the constitution of the kingdom, and of Parliament itself. The privileges of Parliament are very large, and indeed are not strictly defined. Amongst them, that of freedom of speech is the most important and salutary. It is particularly demanded of the King in person by the Speaker of the House of Commons, at the opening of every new parliament. Another privilege consists in the protection of the persons of the members of both Houses from arrest. This privilege, however, does not extend to treason, felony, nor to the case of writing and publishing seditious libels. The franking of letters is also a privilege common to the members of both Houses of Parliament. There are some privileges peculiar to the House of Lords. As they constitute the highest law court in the kingdom, they have a right to be attended by the Judges, the Sergeants at Law, and the Masters in Chancery. Every peer, on obtaining licence from the king, can constitute another Lord of Parliament his proxy, to vote for him in his absence. The peers also enjoy the right of *protest*; that is, each peer may enter on the journals of the House his reasons for dissenting from any vote which passes contrary to his wishes. The privileges peculiar to the House of Commons relate principally to the raising of taxes. All grants of subsidies or parliamentary aids, by the ancient indisputable privilege and right of the House of Commons, begin in their House; nor do they ever suffer the Lords to make any change in the money bills, which are sent up to them.

Mode of opening.

Of proceeding.

On the opening of every session of parliament, the king, either in person or by his commissioners, addresses both Houses, in a speech from the throne. After this, the regular business of Parliament commences. In the House of Lords the Lord Chancellor generally presides as speaker, and regulates their proceedings. The House of Commons always elect their own speaker, who must, however, be presented to the king for his approbation. The speaker of the House of Commons cannot give his opinion, unless the House be resolved into a committee, where he loses, for the time, his character of speaker. The speaker of the upper House is always at liberty to take part in the debate. The Commons cannot proceed to business unless there be 40 members present. Two peers, however, besides the speaker, are sufficient to constitute a House of Lords. All bills, except money bills, may originate in either House. A member first gives notice of his intention to move for leave to bring in a bill. When leave is given, it is read a first time; and at a convenient distance, a second time. After each reading, the speaker puts the question, whether it shall proceed any further? In the House of Commons, the speaker cannot vote unless the *ayes* and *noes* be equal, and then his casting vote decides the majority. But in the House of Lords, the speaker votes with the House; and if the *contents* and *non-contents* be equal, the latter have the effect of an absolute majority. In the House of Commons, two *tellers* are appointed to count the votes on each side.

After the second reading the bill is committed, that is, referred to a committee, either select, or of the whole House. In the latter case, the speaker leaves the chair, and another person is appointed chairman of the committee. In a committee, each member may speak on the question as often as he pleases; whereas, during the regular sittings of the House, no person can speak more than once on any subject, unless in explanation, with the exception of the member who made the motion before the House, who has the privilege of replying, at the conclusion of the debate. The chairman of the committee reports the bill to the House; after which it is read a third time; and one of the members is directed to carry it to the Lords for their concurrence. Here it goes through the same forms as in the other House. When the bills have passed both Houses, they are always deposited in the House of Lords, to wait the royal assent, except bills of supply, which are returned to the Commons. The royal assent is given either by the king in person, or by commission. When the royal assent in either way is given to a bill, then it becomes an act of parliament, and not before. The king, as well as each House of Parliament, possesses the constitutional power of rejecting any bill; but this power has not been exercised since the year 1692, when King William III. refused to pass the bill for triennial parliaments into a law.

Strictly speaking, no strangers have a right to be present in either House during parliamentary proceedings; but in fact, admission is easily obtained. When, however, a division is about to take place, strangers are obliged to withdraw. Till within a comparatively recent period, neither House would permit their debates to be published; but at present they are regularly and fully given to the public in the newspapers.

Duration.

The duration of Parliament was formerly for three years; but in the beginning of the 18th century, the duration was extended to seven years. It seldom happens, however, that Parliament sits out this period.

It is not necessary that there should be the formal promulgation of an act to give it the force of a law; but copies of it are usually transmitted to the chief magistrates throughout the kingdom. When a law is once made, it cannot be repealed, amended, or dispensed with, but by the same authority, and by going through the same forms, by which it was enacted.

Adjournment. Prorogation. Dissolution.

Each House possesses the privilege of *adjourning* itself; by which nothing more is meant than the continuance of the session from one day to another. A *prorogation* is the continuance of Parliament from one session to another. This is done by the king's authority, expressed by the Lord Chancellor in his Majesty's presence, by commission from the crown, and sometimes by proclamation. When Parliament is prorogued, bills which had been begun must be resumed *de novo* in the next session, and go through all the forms again before they can pass into laws. A *dissolution*, which is the civil death of parliament, is effected by the king's will.

Executive power.

With respect to the executive power, and the rights of succession to the throne of England, the fundamental maxim is, that the crown is, "by common law and constitutional custom, *hereditary*; but that the rights of inheritance may from time to time be changed or limited by act of parliament, the crown still continuing hereditary under these limitations." The right of primogeniture amongst the males, and of the males in preference to the females, is a constitutional rule in the descent of the crown. Upon failure of the male line, the crown descends to the eldest of the female issue, and the heirs of her body lawfully begotten, and not jointly to the female issue of the same degree, as in common inheritances. By the statute 12 and 13 William III. chap. 2. the descent is limited to such heirs only of the Princess Sophia, grand-daughter of King James I. as are Protestant members of the church of England, and are married to none but Protestants.

Royal family.

The queen consort has many prerogatives different from other wives. She is a public person distinct from the king, and is able to purchase lands, to convey them, and to make leases, without his concurrence. In short, the law considers her, in all respects, as a single woman; but she is the king's subject, and not his equal. It is high treason to compass or imagine her death, as well as that of the king. It is also high treason to violate her person, and in her likewise if she be consenting. The law regards and protects in a similar manner, the Prince of Wales, his consort, and the Princess Royal. The king's brothers, uncles, grandsons, and nephews, take precedence of all the other nobility. They, as well as the Prince of Wales, and the younger sons of the king, sit in the House of Lords. By statute 12 George III. ch. 11, no descendants of George II. (except the issue of princesses married into foreign families,) can contract matrimony without the previous consent of the king, unless, being of the age of 25, they give a twelvemonths notice of such intention to the privy council, and, before the expiration of that period, no disapprobation is expressed by Parliament.

King's counsellors.

By the constitution of this country, various councils are allotted to the king, to advise him respecting public measures. Besides the Parliament, which has been already mentioned, the peers of the realm are hereditary counsellors of the sovereign, and have a right to demand an audience of him, to lay before him such matters as they shall consider of importance to the state. The judges also, are the king's counsellors in matters of law. But the principal council of the sovereign is his privy council, the members of which are chosen by him, and, on changes of administration, are seldom erased, though those in opposition seldom attend. They are styled right honourable, and are sworn to observe secrecy. The lowest at the board pronounces his opinion first, and the king, if present, concludes with declaring his judgment.

Cabinet council.

The *cabinet council*, as it is called, consists of those ministers of state, who hold the highest rank and dignity. The members are generally 9 or 11; consisting of the lord chancellor, the lord privy seal, the lord president of the council, the three principal secretaries of state, the first lord of the treasury, the chancellor of the exchequer, and the first lord of the admiralty. The first lord of the treasury is considered the premier, or prime minister of the country. It sometimes happens, that the offices of first lord of the treasury, and the chancellor of the exchequer, are held by the same person. No part of the executive authority of the king is vested in his privy council, the constant style of the law being the king in council, and not the king and council. The constitution does not recognise the cabinet council. The king can remove his confidential servants, or "the administration," as it is usually termed, at his pleasure.

Principal officers of state.

The principal officers, who have the management of the political, military, naval, and financial affairs of the kingdom, are the lord high treasurer, or lords commissioners of the treasury; the principal secretaries of state; the secretary at war; the commander in chief; the lord high admiral, or lords commissioners of the admiralty.

Treasury.

The business of the treasury, is to determine on all matters relative to the civil list, or the other revenues of the nation; to give directions for the conduct of all boards, and persons entrusted with the receipt, management, and expenditure of those revenues; to sign all warrants for payments out of them, and generally to superintend every branch of the revenue belonging to his Majesty, or the public. Formerly, there was a lord high treasurer; but for upwards of one hundred years, the management of the treasury has been put in commission; the commissioners being the first lord of the treasury, the chancellor of the exchequer, (to whom is entrusted, in an especial manner, the revenue and expenditure of the nation, and who generally takes the lead on the ministerial side of the House of Commons,) and three other commissioners. Since the union with Ireland, the chancellor of the exchequer of that part of the united kingdom, is, *ex officio*, nominated one of the lords commissioners of the treasury.

Secretaries of state.

There are three principal secretaries of state: the secretary of state for the home department, who has management of, and controul over, the internal affairs of the kingdom, and from whom all directions and commands to the lord lieutenants, sheriffs, and other magistrates, issue; the secretary of state for foreign affairs, who, as the name implies, has the management of all correspondence and transactions with foreign nations; and the secretary of state for war and colonies, who has the management of the affairs of the colonies, and to whom also is entrusted the supreme direction of all warlike expeditions.

Secretary at war.

The commander in chief is at the head of the army. The secretary at war, when there is no commander in chief, (that is, when the king retains actually, as well as virtually, the first military command in the country,) superintends and controuls the discipline, as well as the finance of the army; but when there is a commander in chief, (as there generally is,) he superintends the finance, as distinguished from the discipline of the army; he communicates with the troops in all matters that relate to the police, or law of the country. Some matters of pure discipline, however, are still transacted under his immediate authority; for instance, all that relates to the apprehension and escort of deserters, and in many more cases; though the measure originates with the commander in chief, much of the execution rests with the war office. On the other hand, some considerable branches of finance, (such as the local allowances to troops on foreign stations, and the barrack expenditure in general,) do not come under the war office.

Admiralty.

The special superintendance of the navy is seldom now entrusted to a lord high admiral; but a board of admiralty is appointed, consisting of a first lord, (who, generally, is not a naval officer,) and six subordinate members, among whom are admirals of known skill and experience. The duty of the admiralty is to consider and determine on all matters relative to the navy; to give directions for all services that are to be performed therein, both in its civil and naval branches; and generally, to superintend the naval and marine establishment. The duties of the commissioners of the navy are under the lords of the admiralty, to attend to all affairs regarding the civil establishment of the navy; to make contracts for civil stores, and distribute them; to prepare estimates; to direct all monies for naval services into the hands of the treasurer of the navy; and to examine and certify his accounts. The transport office, which was instituted in 1794, has the charge of the transport service, of sick and wounded seamen, and of prisoners of war.

Coronation oath.

The duty of the Sovereign is expressed in his coronation oath, by which he swears to govern according to the statutes of Parliament, and the laws and customs of the kingdom; to cause law and justice, in mercy, to be executed in all his judgments; and to maintain the Protestant reformed religion.

Royal prerogatives.

The constitution of this country ascribes to the Sovereign the political attribute of absolute perfection. It is an ancient and fundamental maxim, that "the king can do no wrong;" by which is meant, that he cannot be made personally amenable for any wrong which he may actually commit, his minister being responsible, in all cases, for the acts of the Sovereign. By the constitution, also, the king never dies, since, immediately on the natural death of the Sovereign, the regal dignity is vested in his successor. Besides these attributes, the king is considered in law as the sole magistrate of the nation, all other magistrates deriving their power and authority from him; he has also the exclusive power of sending and receiving ambassadors, of making treaties, &c. and of declaring peace or war. By the statute of the 13 Car. II. chap. 6 he has the sole command of all fleets and armies, and of all places of strength in the kingdom.

As the king is considered the prosecutor in all criminal proceedings, he is invested, by the constitution, with the prerogative of pardoning offences. Another branch of the prerogative, is the power of issuing proclamations, by which laws already made are enforced. The other prerogatives of the king, are the power of conferring honours and dignities, either by writ and letters patent, as in the creation of peers and baronets; or by corporeal investiture, as in the creation of a knight, of creating new offices, and of regulating weights and measures, and coining money.

Civil list.

The maintenance of the king's household, and the civil list, are supplied from the annual taxes. The revenues of the civil list consist at present of £800,000, granted by the 1st of George III.; £100,000 granted by the 17th of George III.; £60,000 by the 44th of George III.; £70,000 by the 52d of George III.; and £35,000 the surplus of exchequer fees, granted by 23d of George III. but which fluctuates with the general expenditure of the country: the total revenue of the civil list is thus about £1,065,000. There are 8 classes of expenditure from the civil list. The 1st class comprises pensions and allowances to the royal family. From the year 1804 to 1812, these amounted to about £220,000. By additions made in February 1812, in consequence of the king's illness, they were increased to the sum of £390,000. In the second class, are comprised allowances to the lord chancellor, speaker of the House of Commons, judges of the King's Bench and Common Pleas, barons of the Exchequer, and justices of the Court of Great Session in Wales: in all about £25,000. In the third class, are comprised salaries to foreign ministers: these of course vary according to the extent of our relations with other powers. Under the fourth class, are comprised bills in the departments of the lord chamberlain, lord steward, master of the horse, and master of the robes: about £250,000. In the fifth class, salaries in the above departments about £75,000. The sixth class, comprehends pensions and compensations to old servants, and late ministers at foreign courts: about £120,000. The seventh class comprises small fees and salaries to the amount of about £36,000. And the last class comprehends salaries to the commissioners of the Treasury, and chancellor of the exchequer: about £9000. Besides payments in all these classes, there are occasional payments, which may amount on an average to £150,000.

Different magistrates.

High sheriff.

It has already been mentioned, that the king is the chief magistrate in the country. The principal subordinate magistrates are, the high sheriffs, coroners, justices of the peace, constables, surveyors of highways, and overseers of the poor. The high sheriffs are elected annually by the lord chancellor, the chancellor of the exchequer, the judges, and privy council. The powers and duties of the high sheriff are very great; he determines the election of knights of the shire, and, as the keeper of the king's peace, is the first man in the county, having the power of calling out the *posse comitatus*, or summoning every person above fifteen years old (except peers) to attend him, on pain of fine and imprisonment for disobedience. In his judicial capacity, he may hear and determine all causes of 40s. value. In civil cases, he is to serve the writ, to arrest, and take bail; to summon the jury in all cases, and to see judgment executed. He has under him, the under sheriff, bailiffs, and gaolers.

Coroners.

Justices of the peace.

In every county there are usually four coroners, and sometimes six. They are chosen by the freeholders. Their duty is to inquire into the manner and cause of the death of every person who is supposed to have died by violence, suddenly, or in prison. The inquiry is to be made, on view of the body of the deceased, by a jury, over whom the coroner presides. If, by the coroner's inquest, any one is found guilty of murder or manslaughter, he is to commit the offender for further trial. The next denomination of magistrates are justices of the peace, the principal of whom is the custos rotulorum, or keeper of the records of the county.

atistics.

Justices are appointed by the king's special commission. In this commission some particular justices are directed to be always included, without whom no business can be done; and, from the first word in the commission, these are called Justices of the *Quorum*. Every justice is required to have £100 *per annum* in estate, clearing all deductions. The Lord Chancellor, the Lord Treasurer, the Justices of the Court of King's Bench by their office, and the Master of the Rolls by prescription, are conservators of the peace throughout the kingdom. No practising attorney, solicitor, or proctor, is capable of acting as a justice of the peace. The number of acting resident justices of the peace in England and Wales, is about 1560. There are two kinds of constables; high constables and petty constables: the former preside over a hundred; the latter are inferior officers in every town and parish. The duty of each class is to keep the peace in their several districts. The duty of surveyors of the highways consists in putting into execution the statutes for the repair of the public roads. The overseers of the poor are empowered to raise money, by levying rates on the inhabitants for the maintenance of the poor.

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unicipal aw.

The municipal law of England is divided into the unwritten or common law, and the written or statute law. The common law consists of general customs, the particular customs of certain parts of the kingdom, and those particular laws which are observed by custom only in certain courts and jurisdictions. The proceedings and determinations in the ordinary courts of justice are directed by general customs, or the common law, properly so called. Of these customs the judges are deemed the repositories, the judicial decisions of their predecessors being their guides. The written laws of the kingdom consist of those statutes which are made by the king's majesty, by and with the advice and consent of the lords spiritual and temporal in parliament assembled. If the common law and statute differ, the former gives place to the latter; and an old statute is superseded by a new one; but if a statute that repeals another be itself repealed, the first statute is revived without any formal words for that purpose.

Courts of justice.

Courts of justice in England, are either such as possess general jurisdiction throughout the whole realm, or special jurisdiction only in particular places. Of the former, there are the courts of common law and equity, the ecclesiastical courts, the courts military, and the courts maritime. The court of King's Bench is the supreme court of common law in the kingdom: it is so called, because the Sovereign was understood to judge in person; and its jurisdiction extends to the whole kingdom, the presiding judge being denominated Lord Chief Justice of England. Besides the chief judge, there are three puisne judges. The authority of this court extends to criminal as well as civil cases; the latter is called the crown side, the former the plea side, of the court. It is a court of appeal, into which may be removed all determinations of the court of Common Pleas and of the inferior courts; but from it an appeal lies to the House of Lords, or to the Court of Exchequer. The court of Common Pleas determines all civil actions between man and man, as distinguished from "the pleas of the crown;" which term comprehends all crimes and misdemeanours. In this court there is one chief and three puisne judges. The Court of Exchequer, so termed from the ancient mode of counting upon a chequered board, is a court of law and equity also. It consists of two divisions. The receipt of the exchequer, which manages the royal revenue, and in which all causes relating to it are determined; and the court, or judicial part of it, which is again subdivided into a court of equity and a court of common law. From the equity side of this court, appeals lie immediately to the House of Peers. The whole number of judges is twelve; to all of whom, intricate and important points of law, that may occur in any trial, are referred. They also sit in the House of Lords, in order that they may assist them with their opinion and advice, when that House acts in its judicial capacity. Formerly the judges were dependent on the crown; but his present Majesty began his reign with declaring, "that he looked upon the independence and uprightness of the judges as essential to the impartial administration of justice—as one of the best securities of the rights and liberties of the subjects—and as most conducive to the honour of the crown." Upon this an act was passed, by which the judges are to be continued in office notwithstanding the demise of the crown; nor can they be removed, but by a joint address of both Houses of Parliament to the king. The High Court of Chancery is the most important of all the king's civil courts of justice. It has its name from the judge presiding in it, who is styled Lord High Chancellor, because the highest point in his jurisdiction consists in cancelling the king's letters patent, when they are granted contrary to law. The Lord Chancellor takes precedency of every temporal lord. By his office he is speaker of the House of Lords. To him belongs the appointment of all the justices of the peace throughout the kingdom; and he is patron of all the king's livings under the yearly value of £20 in the king's books. He is also the general guardian of all infants, idiots, and lunatics. The Court of Chancery, in which the Lord High Chancellor alone sits, and determines without a jury, judges causes in equity, in order to moderate the rigour of the law, to defend the helpless from oppression, and especially to extend relief in cases of accident, fraud, and breach of trust. From this court an appeal lies immediately to the House of Peers, which is the supreme court of judicature in the kingdom. From its decision there can be no farther appeal.

Statistics.

Judges.

The courts of assize act as auxiliaries to the courts already mentioned: They are composed of two or three commissioners, who are sent round the kingdom twice every year, except in the four northern counties of Northumberland, Durham, Cumberland, and Westmoreland, in which the assizes are held only once a year.

Trial by jury.

In civil cases.

The trial by jury, handed down from our Saxon ancestors, is the most noble feature in English jurisprudence, and is justly regarded as the safeguard of the lives, liberties, and property of the nation. In civil cases there are two kinds of juries, special and common; special juries were originally introduced, when the causes were too intricate for the discussion of ordinary freeholders. In forming a special jury, the sheriff attends with his freeholders book, and the proper officer takes indiscriminately 48 of the freeholders, 12 of whom are struck off by each of the attornies on both sides. A common jury is returned by the sheriff, who gives in a list containing not less than 48, nor more than 72 jurors, whose names are put into a box, and the 12 first drawn out are sworn on the jury. The jurors may be challenged by either party. Each of the 12 men composing the jury is sworn separately, well and trusty to try the issue between the parties, and a true verdict to give according to the evidence. The pleadings are then opened by the counsel for the plaintiff; after which, the evidence is gone through in support of the case; the counsel on the other side next opens the adverse case, and likewise adduces evidence in support of it; after which, the party who began is heard in reply. One credible witness is sufficient to establish a fact. No man can be a witness in his own cause. The evidence being gone through on both sides, the judge proceeds to sum up the whole to the jury, in the presence of the parties, their counsel, and all others, in open courts. He also gives his opinion to the jury in matters of law arising upon the evidence. If the jury think it necessary, they retire to consider of their verdict. They are kept without meat, drink, fire, or candle, (unless by permission of the judge,) till they are unanimously agreed. When they are agreed, they return back to the bar, and deliver their verdict; that is, they find either for the plaintiff or the defendant. The judgment of the court follows the verdict of the jury; and where the judgment is not suspended, or reversed, execution follows; but the writs of execution must be sued out within a year and a day after judgment is entered. Such are the proceedings in civil cases.

Courts of criminal jurisdiction.

The courts of criminal jurisdiction, are either those of a public and general authority throughout the kingdom; or such as are private and special, being confined to particular parts of the realm. The highest criminal court is the high court of parliament. In it the greatest offenders, whether peers or commoners, are prosecuted and punished by trial or impeachment. An impeachment is a presentment to the House of Lords, by the Commons, in Parliament assembled. A peer may be impeached for any crime, and a commoner for a capital offence, as well as for high misdemeanours. No pardon, under the great seal, is pleadable to an impeachment by the Commons. In cases of impeachment, after evidence is gone through, and counsel heard, each peer declares, on his honour, whether the accused is guilty or not guilty of the crimes laid to his charge, and he is acquitted or condemned, according as the majority of the peers are for or against him. It has already been mentioned, that the Court of King's Bench, on the crown side, takes cognisance of all criminal causes. The High Court of Admiralty takes cognizance of all crimes and offences committed either upon the sea, or upon the coasts. The criminal courts of local jurisdiction, are the courts of oyer and terminer, or courts of assize, held by the judges on the circuit, attended by the justices of the peace of the county wherein the assizes are holden; and the general quarter sessions of the peace, which must be holden in every county, once in every quarter of a year. It is holden before two or more justices of the peace, one of whom must be of the quorum. The jurisdiction of this court extends to all felonies and trespasses; but murders, and other capital felonies, are usually referred to the assizes.

Mode of proceeding in criminal cases.

The regular and ordinary mode of proceeding against a criminal, is, in the first place, by arrest. The usual mode of making an arrest, or of apprehending a person, is by a warrant, granted under the hand and seal of a justice, on the party requiring it making oath concerning the crime committed: but arrests may be executed by officers, without warrant, against persons whom they find in the act of committing a breach of the peace. When an offender is arrested, he is taken before a magistrate, who dismisses him if the charge appears groundless; but if otherwise, he is either committed to prison, or admitted to *bail*, that is, he must give sureties for his appearance to answer the charge against him. On an accusation of treason, or of murder, as well as in many other cases, no bail can be taken; where it is admissible, the law directs it not to be excessive. After the commitment or bail of an offender, follows his prosecution, or formal accusation, which is first before the grand jury: this is the only institution of the kind in Europe. The grand jury is composed of freeholders and gentlemen of the first respectability in the county. It consists of 24 good and lawful men, of whom not fewer than 12, nor more than 23, are to be sworn to discharge the duty which the law imposes on them. The difference between the duty of a grand and petty jury consists in this, that the former hears only the evidence on the part of the prosecution, whereas the latter hears the prisoner's defence and witnesses also. As soon as the grand jury is sworn, the judge delivers to them his charge, remarking on the different subjects of their inquiry, and reminding them of their duty. If after having heard the evidence in support of the accusation, contained in the bill of indictment laid before them, they are of opinion that the accusation is groundless, they indorse the bill with the words "not a true bill," or "not found," and the party is discharged of course; but a new indictment may be preferred to a subsequent grand jury. But if they are satisfied of the truth of the accusation, they indorse upon it, "a true bill." The indictment is then said to be found. Twelve of the grand jury, at least, must assent to the accusation of the party. There is also a method of proceeding, in criminal cases, at the suit of the king, without a previous presentment to a grand jury, which is by way of information; either partly at the suit of the king, and partly of the subject, or in the name of the king alone.

Grand jury.

Outlawry.

If the offender, on the bill of indictment being found, does not appear after being required to surrender himself at five county courts, he is judged to be outlawed, or is rendered incapable of taking any of the benefits of the law, either by bringing actions or otherwise. When the offender appears in court, the indictment is distinctly read to him, and he is then asked whether he be guilty or not guilty: if he confesses the crime, the court awards judgment; if he is obstinately mute, he is considered as convicted: if the prisoner plead not guilty, the sheriff of the county is to return a pannel of jurors, who are to be sworn as they appear, to the number of 12. In all capital cases, the prisoner is allowed to challenge a certain number of them, without assigning any cause whatever; whereas the king can challenge no juror, without assigning a reason, to be allowed by the court. In cases of high treason, petit treason, and misprision of treason, two lawful witnesses are in general necessary to convict a prisoner; but in almost every other case, one witness is sufficient. After the evidence for the prosecution is gone through, the prisoner is called upon for his defence; and when this is finished, the judge sums up the evidence, pointing out the law to the jury, and uniformly instructing them, that if any doubt of the prisoner's guilt rest upon their minds, they are bound to acquit him. The jury then retire to consider their verdict, which must be given in open court. The unanimity of all the twelve persons is the peculiar characteristic of the English jury. If the prisoner is found not guilty, he is for ever discharged of the accusation; but if he be found guilty, the judgment of the court immediately follows, and he can only be pardoned by an exercise of the royal prerogative. This pardon must be under the great seal of England; the ne-

Verdict of the jury.

Royal pardon.

cessary effect of it is the acquitting the offender of all corporal penalties and forfeitures consequent upon his crime. But if no pardon be granted, and the sentence is capital, execution must be performed by the legal officer, the sheriff or his deputy. The only warrant which the sheriff has for executing a criminal is the judge's signature upon the calendar or list of the prisoners names, with their separate judgments in the margin. The time that elapses between the passing and executing of the law is left uncertain in the country, but in Middlesex and London, the day and place are named in the warrant to the sheriffs.

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It is beyond our purpose and limits to enumerate the punishments that the laws of England affix to different crimes: it may, however, be proper briefly to mention, that the punishment of death is affixed in the statute book to more crimes in this than perhaps in any other country; and that hence the laws of England are deemed to be sanguinary. But though the statute book affixes capital punishment to a great variety of crimes, many of which are by no means deserving of it, yet there are perhaps as few crimes actually punished with death in this as in any other country. High treason, murder, and forgery, are generally thus punished. Transportation for life, or for a period of years, is the punishment next to death in our criminal code.

beas rpus.

The natural rights of the people of England, which are secured by the constitution and laws, are the right of personal security; the right of personal liberty; and the right of private property. If any Englishman is deprived of his personal liberty, he may, upon the demand of his council, have a writ of habeas corpus, to bring him before the Court of King's Bench or Common Pleas, who shall determine whether the cause of his commitment be just. The celebrated statute, by which the liberty of the subject is thus secured, was passed in the reign of Charles II. 1679. The principal provisions of the act are, to fix the period for bringing the prisoner into court; to oblige the keeper of the prison, within six hours, to furnish him with a copy of his commitment, and to prevent a recommitment for the same offence. Circumstances, however, sometimes arise, which render it necessary to suspend the habeas corpus act for a limited time.

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With respect to private property, it cannot be taken for the public good, on any tax levied upon the subject, without his consent, expressed by his representatives in Parliament. Besides these rights, that are secured to the subject, he has the right of petitioning the king or either house of Parliament; and of having arms for his self-defence and preservation, such as are allowed by law according to his desire. In treating of these points, by which the English constitution is distinguished, it would be unpardonable to pass over the liberty of the press: it may be considered as consisting simply in this, that neither the courts of justice, nor any other judges whatever, can lawfully take any notice of writings intended for publication, but only of those that are actually published, and in these cases, they must proceed in the trial by jury. In indictments for libels, the province of the jury is to determine on the points of law, as well as on the matter of fact; that is, to decide, not only whether the libel in question has been written by the person charged with having done it, but also whether the contents be criminal or not. It is, however, a doctrine of English law on this subject, that it is of no importance whether the matter of the libels be true or false, as the guilt of the persons consists in the provoking of another to break the peace; and this may be as easily done by publishing a truth as a falsehood.

Church of England.

By the constitution, the king is considered as the supreme head, on earth, of the church of England. By this authority he convenes, prorogues, restrains, regulates, and dissolves all synods and ecclesiastical convocations. The convocation of the clergy in England, however, have never been allowed to transact any business since the reign of Queen Anne. The ministers of the established church are denominated the clergy, a term which comprehends all persons either in holy orders, or in ecclesiastical offices. The different orders of the clergy of the church of England, essential to the constitution of episcopal government, are those of bishops, priests, and deacons; but there are other officers, which, though not essentially necessary, have been gradually introduced, as archbishops, deans, prebendaries, minor canons, archdeacons, church-wardens, parish clerks, and the like. The episcopacy of England consists of the two archbishops of Canterbury and York, and 24 bishops, who, upon confirmation, may sit in Parliament; there is also the Bishop of Soder and Man, who has no seat in the House of Lords. The archbishop is the chief of the rest of the bishops, and all the inferior clergy in his province; he has the right to present to all vacant livings in the disposal of his bishops, if they are not filled in six months. The Archbishop of Canterbury enjoys some privileges above the Archbishop of York; to him belongs the privilege of crowning the kings and queens of England; and of granting special licences to marry at any time or place, to hold two livings, &c. He is styled the primate of all England, and precedes all persons except the royal family.

Ecclesiastical geography.

The province of Canterbury comprehends, 1st, The bishopric of London, containing Essex, Middlesex, and part of Hertfordshire: 2d, The bishopric of Winchester, containing Surry, Hampshire, Jersey, Guernsey, and Alderney: 3d, The bishopric of Litchfield and Coventry, containing Stafford, Derby, and part of Warwick and Shropshire: 4th, The bishopric of Lincoln, containing Lincoln, Leicester, Huntingdon, Bedford, Buckingham, and part of Hertford: 5th, Ely, containing Cambridgeshire: 6th, Salisbury, containing Wilts and Berkshire: 7th, Exeter, containing Cornwall and Devon: 8th, Bath and Wells, containing Somersetshire: 9th, Chichester, containing Sussex: 10th, Norwich, containing Norfolk, Suffolk, and a small part of Cambridgeshire: 11th, Worcester, containing Worcester and a part of Warwick: 12th, Hereford, containing Hereford and a part of Shropshire: 13th, Rochester, containing Kent: 14th, Oxford, containing Oxfordshire: 15th, Peterborough, containing Northampton and Rutland: 16th, Gloucester, containing Gloucestershire: 17th, Bristol, containing the city of Bristol, part of Gloucestershire, and Dorsetshire: 18th, Landaff, containing Glamorgan, Monmouth, Brecon, and Radnor: 19th, St David's, containing Pembroke, Cardigan, and Caermarthen: 20th, St Asaph, containing the greatest part of Flint, Denbigh, Montgomery, and part of Shropshire: and, 21st, Bangor, containing Anglesey, Caernarvon, Merioneth, and part of Denbigh and Montgomery.

In the province of the Archbishop of York, (who is termed the Primate of England), there is, 1st, The bishopric of Durham, which contains Durham and Northumberland: 2d, Carlisle, which contains great part of Cumberland and Westmoreland: 3d, Chester, containing Cheshire, Lancashire, Richmondshire in Yorkshire, with part of Cumberland and Westmoreland: and, 4th, The Isle of Man.

Archbishops and Bishops.

Archbishops and bishops are appointed by the king, by what is called a *congè d'elire*, or leave to elect, which is sent to the dean and chapter, naming the person to be chosen. The prelate pays homage to the king for his temporalities, or the baronies connected with the see; and compounds for the first fruits, that is the revenue of the first year, which goes towards increasing the revenues of the poor clergy. All the bishops are sole judges in their own courts, and issue writs in their own names, not in the royal style used by other courts. The Bishop of London, as presiding over the capital, has the precedence of all the others. The Bishop of Durham, as presiding over a see that constitutes a county palatine, has great powers and prerogatives; even the king's judges only sit in his diocese by his permission. The Bishop of Winchester is the third in dignity; all the rest of the bishops take their places according to the seniority of their consecration. The revenues of the bishops vary very much, and are much greater now than they were formerly, being derived from lands and mines, the annual income from which is of course greatly enhanced. The revenue of the Bishop of Durham is supposed to be the largest; and in some years, it is said to have reached nearly £20,000; the amount of the revenues of the two Archbishops, and of the Bishops of London and Winchester, is probably next to that of the Bishop of Durham.

To every cathedral belong several prebendaries and a dean, who form the dean and chapter, a council appointed to assist the bishop with their advice in ecclesiastical and other matters relative to the see. At the Reformation, their salaries were mostly converted into money, but those of Durham preferred the ancient portions of land, which have increased so much in value, that they are now styled golden prebends.

The next order is that of archdeacons; their number is about 60; their office is to inspect the moveables of the churches, to reform slight abuses, and to induct into benefices.

Parochial clergy.

The most numerous, as well as most laborious order of the clergy, are the deacons, curates, vicars, and rectors: formerly, the office of the deacons was to superintend the poor, the ancient donations to the church being assigned in three divisions, one to the poor, another for repairs, and the third for the clergy; at present, the office of the deacon is restricted to baptism, to reading in the church, and assisting the priest at the communion, by handing the cup, only a person cannot be ordained a deacon under the age of 23 years; a priest must be 24, and a bishop 30. A *parson* is one who has full possession of all the rights of a parish church: during his life, he has the freehold of the parsonage house, glebe, tithes, &c.; and for the most part, he has the right to all the ecclesiastical dues in the parish. If the prideal, or great tithes, (such as those of corn, hay, &c.), be impropriated, or converted into secular hands, the priest is termed a vicar, a name implying that they are the *vicarii*, or deputies of the rector; but if the tithes be entire, the priest is styled rector. A curate signifies one who is not instituted to the cure of souls, but exercises the spiritual office in a parish under the rector or vicar. The churchwardens superintend the repairs and decorations of the church, and the requisites for divine service, as well as collect the alms of the parishioners: they are annually elected at Easter. The sacristan, or sexton, originally had the care of the furniture and plate of the church; but the appellation is now applied to the grave-digger.

Annual income of the church.

The annual income of the clergy of the church of England of all ranks, is supposed to be about £3,000,000; but the average annual income of the parochial clergy, or rectors, vicars, and curates, does not exceed £100. This income is derived principally from tithes; but it is a mistaken idea to suppose that all the tithes are in the hands of the clergy,—a great proportion of them belong to laymen.

The following Table exhibits the annual value of land in all the counties of England and Wales that is tithe-free, titheable, tithe-free in part, and tithe-free on payment of a *modus*, which is a very small and inadequate compensation.

Counties.	Tithe-free.	Titheable.	Tithe-free in part.	On payment of Modus.
Bedford	£186,589 6 3	85,031 13 9	£524 5 0	£475 15 0
Berks	88,441 3 0	316,709 10 9	— — —	— — —
Bucks	303,920 8 8	182,202 14 11	12,554 15 0	— — —
Cambridge	107.045 19 10	342.719 12 9	2,515 0 0	935 0 0
Chester	28,412 9 4	646,865 6 8	1,236 15 0	349 7 4
Cornwall	2,153 10 0	561,846 3 0	510 0 0	1,963 3 0
Cumberland	69,094 0 6	312,645 10 8	71,759 7 6	15,751 10 0
Derby	230,528 15 3	310,149 7 3	78,739 13 0	2,275 17 0
Devon	28,917 17 11	1,181,142 2 5	4,967 0 0	2,520 0 0
Dorset	48,853 17 4	436,642 11 10	545 0 0	2,984 0 0
Durham	143,073 9 0	358,441 7 3	3,269 10 9	1,278 15 4
York	1,424,883 11 7	1,410.020 5 3	170,849 17 4	105,864 15 11
Essex	72,796 19 0	826,784 12 5	1,798 0 0	3,236 0 0
Gloucester	254,446 7 4	545,562 8 7	— — —	5,124 11 0
Hereford	21,340 3 4	432 267 9 0	— — —	— — —
Hertford	76,150 10 0	264,616 16 7	1,483 13 4	100 0 0
Huntingdon	119,176 14 10	56,367 8 10	16,895 4 0	11,637 0 6
Kent	11,290 5 6	849,040 19 8	7,857 6 0	— — —
Lancaster	129,313 17 2	1,131,425 15 10	2,643 5 0	6,962 0 0
Carry forward	£3,346,429 6 10	£10,250,481 17 5	£378,148 11 11	£161,457 15 1

Counties.	Tithe-free.	Titheable.	Tithe-free in part.	On payment of Modus.
Brought forward	£3,346,429 6 10	£10,250,481 17 5	£378,148 11 11	£161,457 15 1
Leicester	488,076 5 4	173,528 15 1	18,514 5 10	22,282 18 2
Lincoln	938,093 11 6	499,009 1 7	107,729 7 3	37,108 10 6
Norfolk	103,944 7 6	823,218 3 8	4,270 0 6	410 0 0
Northampton	560,556 17 9	114,097 15 11	13,070 17 9	8,911 9 7
Northumberland . . .	293,057 2 5	433,037 13 7	129,897 15 4	50,797 0 0
Nottingham	340,163 3 2	183,548 0 0	4,036 0 0	7,245 0 0
Oxford	275,140 6 1	219,105 14 7	2,057 0 0	1,322 0 0
Rutland	63,316 1 1	15,148 16 8	20,149 17 4	560 0 0
Salop	92,327 12 9	639,150 9 6	4,200 0 0	2,817 6 0
Somerset	54,316 6 6	1,296,577 6 0	4,214 5 0	— — —
Southampton	25,582 9 3	568,437 11 0	— — —	— — —
Stafford	139,442 16 4	617,192 9 0	— — —	— — —
Suffolk	60,425 14 0	624,253 16 0	6,486 2 0	2,912 10 0
Surrey	55,530 18 11	300,564 6 2¾	3,746 5 0	10,000 0 0
Sussex	54,109 3 5	410,256 7 1	13,506 14 11	72,077 16 8
Warwick	280,103 6 9½	208,214 9 10½	112,097 7 11	44,724 5 10
Westmoreland	107,185 3 10	81,724 4 3	10,658 8 0	21,988 10 3
Wilts	218,674 12 2	562,160 15 6	21,004 1 5	8,788 6 11
Worcester	149,277 8 8	363,728 1 1	1,276 12 0	1,921 3 0
Anglesey	45,854 11 2	19,767 0 0	— — —	— — —
Brecon	738 0 0	107,708 7 2	— — —	— — —
Cardigan	288 0 0	101,262 2 8	— — —	— — —
Caermarthen	151 6 0	224,001 7 2	— — —	— — —
Caernarvon	88,075 17 1	2,772 9 10	— — —	— — —
Denbigh	— — —	182,674 0 5	— — —	— — —
Flint	— — —	118,615 0 4	— — —	— — —
Glamorgan	1,637 13 4	165,689 14 9	— — —	43,433 1 4
Merioneth	272 0 0	83,179 10 9	— — —	— — —
Monmouth	30,131 0 0	173,445 1 0	— — —	— — —
Montgomery	2,745 0 0	149,258 8 0	— — —	5 0 0
Pembroke	4,370 15 4	156,246 11 5	— — —	— — —
Radnor	2,235 6 6	86,015 12 4	— — —	— — —
Westminster	2,032 0 0	1,023 0 0	— — —	— — —
Middlesex	80,594 14 8	264,372 17 8	1,120 0 0	— — —
	£7,904,378 17 4½	£20,217,466 17 7	£856,183 12 2	£498,823 3 4

The next Table exhibits, according to the last diocesan return, the number of parishes in each diocese; the population of each diocese; the number of churches and chapels; the number of persons which they will contain; and the number of dissenting places of worship in each diocese.

Dioceses.	Number of Parishes.	Population.	Number of Churches and Chapels.	Number of Persons they will contain.	Number of Dissenting Places of Worship.
St Asaph	41	104,708	49	45,280	96
Bangor	40	52,886	52	27,141	100
Bath and Wells	55	129,965	78	57,800	103
Bristol	41	83,766	58	40,216	71
Canterbury	67	175,625	83	67,705	113
Carlisle	29	58,459	49	25,108	39
Chester	257	568,826	351	220,542	439
Chichester	41	73,313	47	34,690	58
St Davids, no returns.					
Durham	75	298,755	113	63,259	173
Ely	14	32,425	22	14,810	33
Exeter	159	362,551	176	152,019	234
Gloucester	36	87,934	46	46,931	76
Hereford	33	82,567	51	39,483	42
Carry over	888	2,111,780	1175	834,984	1577

Dioceses.	Number of Parishes.	Population.	Number of Churches and Chapels.	Number of Persons they will contain.	Number of Dissenting Places of Worship.
Brought forward	888	2,111,780	1175	834,984	1577
Landaff	11	28,200	21	12,350	42
Lichfield and Coventry	129	430,231	189	122,756	294
Lincoln	129	213,033	165	104,644	269
London	132	661,394	186	162,962	265
Norwich	70	135,900	78	64,668	114
Oxford	30	36,251	50	35,520	38
Peterborough	17	34,825	20	19,450	37
Rochester	24	105,142	36	25,280	44
Salisbury	83	142,609	134	72,243	142
Winchester	120	371,206	193	115,711	165
Worcester	40	75,239	66	36,263	59
York	108	591,972	220	149,277	392
Totals	1,881	4,937,782	2,533	1,856,108	3,438

According to the last diocesan return, the total number of benefices in England and Wales (including 133 dignities), was 10,582; the number of non-resident parochial clergy was 5037, of which, however, 986 did duty; and the number of residents 5397; the number of curates on livings where the incumbents were not resident, was 3926. The following Table exhibits the respective number of curates who had salaries from £10 per annum to above 270.

59	from £10	to £20	5	of	£140
217	20	30	2		150
679	30	40	8		160
683	40	50	2		170
517	50	60	1		180
347	60	70	1		190
309	70	80	None		200
165	80	90	3		250
50	90	100	1		270
130	100	110	1	above	270
6		120	1		400
11	120	130			

The convocation, the highest of the ecclesiastical courts, has already been mentioned: the next in dignity is the court of delegates, then the court of arches: there are also courts of audience, of prerogative, and of peculiars.

Doctrines.

The special tenets of the church of England are given in the 39 articles; but some of the most learned and conscientious of her divines have doubted whether they are Calvinistic or Lutheran.

Dissenters.

The law considers all persons as dissenters, who do not conform to the church of England in the established mode of religious worship, agreeably to the statutes 1 Elizabeth, chap. i.; and 13 Charles II. chap. 4. called the Acts of Uniformity. Latterly, however, and especially during the present reign, toleration has been greatly extended to dissenters from the church of England. The principal classes of dissenters are the Presbyterians, Independents, Papists, Methodists, Quakers, Swedenborgians, and Unitarians. The Presbyterians and Independents are scattered over all England and Wales. The Papists, or Roman Catholics, are, for the most part, confined to Lancashire, Yorkshire, Staffordshire, Warwickshire, and Northumberland. The counties in which they are most numerous after these, are Durham, Cheshire, Norfolk, Suffolk, Kent, and Worcester. The total number in all these counties is supposed to be 200,000; in London, Surry, and Middlesex, it is supposed there are 50,000; and in Bristol, Bath, Portsmouth, Plymouth, Southampton, Exeter, Gloucester, and in a few other places, 50,000 more; making in all 300,000. There are 900 Roman Catholic chapels, of which 100 are in Lancashire.

Methodists.

The Methodists sprung up in England about 70 years ago: there are two grand divisions of them—the followers of Whitfield, who are Calvinists; these are not numerous, nor are they increasing: and the followers of Wesley, whose creed is Arminian. These have increased, and are increasing rapidly, their number in England and Wales being nearly 150,000.

Quakers.

The society of Quakers, or Friends as they style themselves, also originated in England; but they are not numerous, and are probably not increasing, not being anxious to make converts. The greatest number of them is in London, and in the northern counties, particularly Lancashire, Yorkshire, and Westmoreland. The followers of Swedenborgi are far from numerous. The modern Unitarians, of whom Dr Priestley may be considered the founder, are also far from numerous, being principally found in the North and West of England, and in the metropolis.

Remarks on the civil and religious liberty of Englishmen.

The civil and religious freedom which Englishmen enjoy, and by which they are proudly and happily distinguished from all the other nations of the earth, ought not, however, to be attributed solely to the constitution and laws under which they live. The same constitution and laws would fail to produce or ensure the same blessings in any other country: they would be a dead letter even here, if those who govern, as well as those who are governed, were not so enlightened, as to be firmly and deeply convinced; the latter, that if their civil or religious liberties were infringed, both their individual and national security and happiness would be endangered; and the former, that any attempt to infringe them would be in vain; and that, in fact, they as rulers, as well as the people over whom they rule, are much more secure and happy, while civil and religious liberty is entire, than if it were to be broken in upon.

CHAP. XII.

Language, Literature, Arts and Sciences, Education, Manners and Customs, Antiquities.

Language. THE language of England is radically Gothic, there being scarcely any words in it that can be traced to the Celtic, though there is no doubt that the original population of the country was Celtic. From the European languages of Latin origin and etymology, the French, Italian, and Spanish, but most particularly the French, the English language has derived a vast number of words, some of which are synonymous, or nearly so, with those of Gothic origin, and others have been incorporated, in order to supply the necessary terms for those new objects and ideas which civilization and science introduce. Of the Gothic dialects, the Belgic, Saxon, and Danish, the first has supplied more words than either of the others to the English tongue.

The Anglo-Saxon is the oldest dialect of the English language; in this dialect numerous manuscripts exist: one of its most classic authors is Alfred, whose translations of Bede and Boethius from the Latin into the Anglo-Saxon, have been published. At the time of the Norman Conquest, Norman French was introduced; but though it was the prevalent language among the nobility and warriors, it does not seem to have added many terms to the Anglo-Saxon, or to have changed the idiom or grammatical construction of the latter till a considerable time after that period. The constant intercourse, however, between England and France, and especially the conquests of Edward III. effected, in the 14th century, a change in vain attempted by the Norman Conqueror. Chaucer in poetry, and Sir John Mandeville in prose, are supposed to exhibit the first specimens of what may be termed the English language.

The advances of the language towards regular construction, during the fifteenth century, were very great; but from the reign of Edward VI. to the reign of Henry VIII. it underwent very little change or improvement. In the reign of Queen Elizabeth, as the English character then rose to a high degree of energy, vigour, and independence, in respect both to mental and moral qualities; so the language itself advanced to a degree of copiousness, dignity, force, and melody, which certainly has not been surpassed. That it did not lose any of those noble characteristics in the subsequent reign, is abundantly and unequivocally proved, by the common translation of the Bible, which was executed at that period.

Dignity and force continued in an especial manner to distinguish the language, till the restoration, when elegance and smartness, in some degree, began to occupy their place. The style of Addison and his contemporary wits, has been justly celebrated for its neatness and simplicity; but it is undoubtedly deficient in energy, and by no means remarkable for grammatical correctness. Since that time, neither the English language or style have undergone any improvements.

Literature. It is absolutely impossible, in this article, even to give a rapid and very brief sketch of English literature. It is distinguished from the literature of most of the continental nations, by unambitious good sense, solidity of judgment, and its application, in a more direct and certain manner, to the regulation of domestic and social life. Another grand feature of the English literature is, original genius, which shines forth so conspicuously in the writings of Shakespeare, Milton, Newton, and Locke. As contradistinguished from Scotch literature, the literature of England may be characterised as more learned, but less metaphysical.

Science. Since the days of Newton, England has not been eminently distinguished for mathematical science; but towards the wonderful discoveries which the present age has witnessed in chemistry and the physical sciences, she has contributed an ample portion. The sciences connected with the healing art, have made great advances in England. Perhaps our surgeons are not superior to those of France, but our physicians are decidedly superior to the physicians of the continent, in their education, manners, professional knowledge, general respectability, rank and wealth.

Painting. Till the 18th century, this country had scarcely any native painters of merit; and it may be added, that it has been only during the reign of George III. that this art has met with much encouragement, or displayed much improvement. Even yet, in painting, engraving, and architecture, England has not made great advances. In music, she is still more deficient; for while almost every nation on the continent, and her sister nations of Ireland and Scotland, have their respective national music, England is without it.

Education. The higher and middle ranks of English give their children an expensive, and, in some respects, an excellent education; but till the institution of Sunday and Lancasterian schools, the education of the great bulk of the people was miserably and lamentably deficient. The most distinguished and extensive of the public schools are those of Eton, Westminster, St Paul's, Harrow, Rugby, and Winchester. There are only two universities, at Oxford and Cambridge; at the former, classical learning is the favourite pursuit; at the latter, mathematical learning.

English character. The distinguishing features of the English character, are independence of mind and conduct; a reserve, tinctured with austerity and pride; great fondness for domestic life; a disregard of, and contempt for, show and theatrical effect in what they say and do; and a decided preference of comfort to extravagance. Food. In their diet, they are distinguished from most other nations, by the very large proportion of animal food which they consume; Drink. their favourite liquors are ale, porter, and port wine; for lighter wines, even the highest ranks have little relish. Tea, which is rarely met with on the continent, is drank here in immense quantities by all ranks and classes of people. Dress. Their cookery and dress are particularly simple: with respect to the latter, it is impossible, by their dress, to distinguish the sons of the king from the plainest tradesmen The houses in England, as well as the persons of the people, bear unequivocal testimony to their minute and scrupulous regard to cleanliness. Diseases. The prevalent disorders are, consumption, fevers, apoplexy, palsy, and lunacy: towards some of those, the uncertainty of the climate evidently contributes: towards others, the quantity of animal food and of strong liquors which are consumed. The cleanliness of persons, houses, and streets, however, which are everywhere met with, as well as the improvements in draining land, which have taken place during the last century, have rendered England a much more healthy country than it formerly was.

The English nobility and gentry spend a large portion of their time on their estates in the country; and many of them instruct and amuse themselves, as well

Statistics.

as benefit their fellow-subjects, by their attention to agriculture. Some of their country-seats are magnificent specimens of architecture; but, in general, they are rather commodious and elegant, than noble and extensive. The grounds around them, however, are almost in every instance laid out with great taste and effect.

Antiquities.

The antiquities of England are generally arranged under six classes: 1. Celtic; 2. Belgic; 3. Roman; 4. Saxon; 5. Danish; and, 6. Norman. It is extremely doubtful, however, whether there are any antiquities really Celtic. Stonehenge is probably Belgic. The Roman antiquities are very numerous, and some of them in good preservation. A great many Roman inscriptions, altars, &c. have been found along the frontier-wall from the Western Sea to the Tyne; and traces of Roman roads are visible, from Richborough in Kent, through London, to Chester; from London to Lincoln; and from Norwich into Dorsetshire. The Saxon antiquities are chiefly sacred or secular edifices; the Danish are camps, and some castles, to the north of the Humber; and the Norman are castles and cathedrals, of which latter, those of Durham and Winchester may be particularly noticed.

Works consulted in drawing up this article.

In drawing up the preceding article, a great variety of books have been consulted for particular points, the titles of which it is not necessary to give here, since, unless on these points, they afford little or no information respecting the statistics of England.

The works principally consulted were, the agricultural reports of the different counties; the various travels in England; the *Monthly Magazine*, the early volumes of which contain many valuable papers on the manufactures, &c. of different towns and districts. Macpherson's *Annals of Commerce*. Chalmers' *Estimate of the Resources of Great Britain*. Aikin's *Manchester*. Aikin's (A.) *Tour in North Wales*. Campbell's *Political Survey of Great Britain*. M'Arthur's *Political Facts*. *Political Essays concerning the Present State of the British Empire*, 1772. The different county histories that have been published. *Beauties of England and Wales*. Skeene's *Rivers of Great Britain*. Young's *Political Arithmetic*; his *Tours*; and *Annals of Agriculture*. *Commercial Magazine*. Wenderburn's *View of England*. Zimmerman's *Survey of Europe*. Williams *On the Climate of Great Britain*. Colquhoun *On the Police of the Metropolis*; *On the River Police*; *On Indigence*. Bakewell's *Introduction to Geology*. Becke *On the Income Tax*. Luccock *On Wool*. *Observations on the Cotton Trade of Great Britain*.

Much information was also derived from different Reports of Committees of the House of Commons, particularly the following: *Report on the Woollen Manufacture of England*, 1806. *Evidence on the Petitions of the Calico Printers*, 1803, 1804, and 1806. *Report on the Cotton Weaver Journeymen's Petition*, 1809. *Reports on the Distillation of Sugar*, 1808. *Finance Reports*. *Population Reports*, 1801, 1811. *Returns respecting the Poor*, 1803. *Bullion Report*. *Evidence on the East India Company's Affairs*, 1812, 1813. *Evidence respecting the Orders in Council*, 1808 and 1812. *Report on the Duties on Leather*, 1812, 1813.

Much valuable information was also derived respecting the principal manufactures, from persons resident in the respective districts where they are carried on, and well acquainted with their present state. (W. S.)

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⁎ _The numbers of the pages between p. 589 and p. 761, refer to Vol. VIII, and those from p. 1 to p. 36, refer to Vol. IX._

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ENGRAVING.

ENGRAVING is the art of executing by incision on plates of metal, blocks of wood, &c. the representation of visible objects, with a view to the working off impressions from them. These impressions are called prints.

Antiquity of the art.

Although the art of engraving, considered in its application to the taking off impressions, be entirely a modern invention, the art itself was practised by the ancients from the earliest times, in various ways, such as in the decorations of articles of household furniture, and in the ornaments of dress, such as rings, clasps, &c. and in the embellishing of shields, helmets, swords, and other warlike instruments, as well as in the cutting of signets or seals. In these respects, however, it must be considered as a modification of sculpture.

It is probable that the first essays of engraving were only rude delineations expressed by simple outlines, such as are described by Herodotus as traced upon the shields of the Carians.

Its importance.

The dignity and importance of this art are universally acknowledged, whether considering the great advantages which society derives from its productions, or the high qualifications requisite for its professors. By means of it, the spirit of those splendid and costly productions of the art of painting, whether the representation of some great historical fact, or the embodying and giving a 'local habitation' to the sublime conceptions of the poet, which, without its assistance, would be for ever confined to the palaces of the great, is transferred upon paper in a cheap and portable shape, and multiplied and disseminated over distant countries to any extent. By it, portraits of the patriot, hero, and statesman, the philosopher and the poet, and others who have rendered themselves illustrious or useful to society, are also handed down to a grateful posterity; and in its humbler, though not less useful department, it is of great assistance to the philosopher and man of science, in the illustrations it affords to his written descriptions.

Bezaleel and Aholiab supposed to have been engravers.

The book of Genesis contains the earliest record extant of the exercise of the art. In it, Bezaleel and Aholiab are mentioned as being professedly engravers, and are designated as "filled with wisdom of heart to work all manner of work with the graver, as well as to devise cunning works; to work in gold, and in silver, and in brass, and in cutting of stones, and to set them." These and other arts employed by the Israelites in the decorations of the tabernacle, which they must have learnt of the Egyptians, shew a considerable advancement in the luxuries of life, and sufficiently warrant the conclusion, that the art was, even at that time, not in its infancy. Mention is also often made in the sacred writings, at a time much anterior to this, of the existence of signets, rings, and bracelets, which it is reasonable to suppose, however rudely executed, were engraved or carved.

But as the words that are used in the various ancient languages are not sufficiently definite, being equally applicable to carving, engraving, or chasing, there can be but little deduced with certainty from them. A short view, therefore, of the relics of antiquity now extant, will convey a more precise idea of ancient engraving.

Ancient Egyptian engraving.

The hieroglyphic figures of the Egyptians are perhaps the most ancient remains of engraving on metal; they have been frequently met with, chiefly in the coffins of mummies, where they had been deposited as a sort of talismans. There are in the British Museum several fine specimens of these figures. One of these, which bears every mark of high antiquity, has been minutely described by Mr Strutt. (See *Dictionary of Engravers.*) "It represents Isis, and is carved in alto-relievo; the goddess appears standing on two crocodiles, holding in each hand two serpents, a creature like a scorpion, and a four-footed animal; from the tails of the crocodiles arise two ornaments; upon the top of one is a bird, but the representation on the top of the other is so much obliterated by time, that it cannot be ascertained. The flat part of the relief, together with the bottom edges and back part of it, are ornamented with figures and symbolical representations, executed entirely with the graver, without any other assistance; the backs of the crocodiles, and the heads of the four-footed animals, are also finished with the same instrument, in a very careful manner. It is four inches high, and three inches four-tenths at the bottom, from which it gradually decreases to the breadth of three inches at the top."

Etruscan.

Among the Etruscan antiquities at the British Museum, collected by Sir William Hamilton, are two specimens of the art of engraving at a very remote period; a representation of which forms the frontispiece to one of the volumes of Strutt's Dictionary. "'One of them," as he describes it, "is a sheath to a parazonium or dagger. It is more than three inches and three-quarters wide at the top, and decreases gradually to an inch and a quarter at the bottom; its present length is eight inches and a half: the story engraved upon it appears to be taken from Homer. The trophy at the bottom is symbolical of war; above the trophy, two warriors are delineated, with a woman, who seems to accompany them with great reluctance, which I conceive may represent Paris and his accomplice conducting Helen to the ship, in order to make her escape to Troy; and at the top, the messenger, the servant of Menelaus, is relating to his lord the ungrateful behaviour of his Trojan guest. The figures are exceedingly rude, and seem to indicate the very infancy of the art of engraving, for they are executed with the graver only, upon a flat surface, and need only to be filled with ink, and run through the press, (provided the plate could endure the operation), to produce a fair and perfect impression."

He likewise gives the representation of "another valuable specimen of ancient engraving, greatly superior in workmanship to the former. It is a patera, or instrument used by the priests in their sacrifices; and it is supposed, with great reason, to have belonged to an altar dedicated to Hercules, who is represented combating, as it appears to me, Hippolite, the Queen of the Amazons, whose girdle he was enjoined by Erystheus to unloose and take from her."

But M. D'Ankerville, who has drawn up a descriptive catalogue of the antiquities collected by Sir William Hamilton, conceives it to represent Minerva leaning upon the head of that hero, and pressing him forward in the arduous path of glory; his bow and quiver are behind him. It is precisely seven inches in diameter, and about half an inch thick, apparently made of brass, but the ornaments and border are inlaid with silver. The figures and ornaments are carved in bas-relief, but the hair of the woman, and the smaller folds and ornaments of the drapery, are executed solely with the graver. The letters which compose the inscription must be read from right to left,—another strong proof of its great antiquity.

Engraved seals or signets very ancient.

Another application of the art of the engraver, which seems to have been practised from the most remote antiquity, was the making of seals or signets, which were used as instruments of ratification. Mention of them is made in the sacred books as far back as the times of the patriarchs, as well as in the other early writings of the ancients. It is probable they were engraved on metal, and the impressions taken from them on wax, or some such soft ductile substance. In Hindostan, the art of engraving must have been known at a very remote period, as would appear from the specimens, which we have in this country, of the state of the art with them, described by M. Lanseer. As the date of one of them is ascertained, and as the execution displays considerable advancement, it shews that it must have been practised long before. "They are both deeds of transfer of land, engraven on tablets of copper, with seals appended to them of the same metal, which seem to have been struck like coins from an intaglio matrix. They are both in the Sanscrit language. One of them, which is now in the possession of the Earl of Mansfield, has been copied in fac-simile, and inserted, with an English translation by Mr Wilkins, into the first volume of the Asiatic Researches. It is dated 20 years before Christ; and it is further remarkable, that the date is expressed in Hindoo numerals, very much resembling the numerals now in use. The other, which is likewise engraved in the same manner, has the appendant seal impressed on a ponderous lump of copper, and attached to the deed itself by a massive ring of the same metal. The matrix must have been an engraving of no mean workmanship, and it exhibits a style of art similar, and not inferior, to the best of the present productions of the art of Hindostan; it is in alto-relievo, and being bedded in the metal, is in high preservation. Its subject is mythological; its form a circle of about ten inches in circumference; and the weight of the metal on which it is stamped not less than four or five pounds. It was presented to Mr Neave by Mirza Hazy, grandson of Shah Alum, the present Emperor of Hindostan, and was found in digging a foundation within the scite of the ancient fort of Benares, on the Banks of the Ganges."

In Hindostan.

Die-sinking.

The art of die-sinking for stamping coins, though by no means of so early a date as the engraving of seals, was practised at a very early period. It is uncertain whether the coining of money was invented by the Greeks or Lydians, though some suppose that the art was brought from Hindostan. The first Greek money is supposed to have been struck by Phidon, King of the Argives, whose reign is fixed by the Arundelian marbles at about eight centuries before the Christian era, or soon after the age of Homer. Many of the early Greek and Sicilian coins are beautiful, and in high relief; to this, however, the coins of Athens form a remarkable exception, being in a very inferior style of execution. The art seems to have been communicated to the Romans in the reign of Servius Tullius, about 460 years before the commencement of our era, by the Lydian colony settled in Etruria. The best of the Roman medals are the work of Greek artists, executed during the reign of Adrian.

Ancients unacquainted with working off impressions.

The ancients, it has thus been shewn, possessed as much knowledge in the art of engraving, as would have enabled them, had they known the method of working off impressions, to have carried it to any extent. And the same may be said with regard to printing, when we consider the stamps for pottery or packages, and other purposes, preserved in the Hamiltonian collection, having even gone so far as to form three lines under each other. Several of these have been described and copied by Strutt in his dictionary, and by Mr Lanseer in his Lectures on Engraving. They are in general of a composition like brass, and some of them in stone. In some the letters are raised, the ground being hollowed out between them to the depth of the eighth of an inch, and cut in reverse like printing types, in order that in the impression they may appear the right way. In others, the letters are cut in intaglio. One of these, copied by Strutt, supposed to be an amulet or charm, to secure the wearer from certain diseases or danger, has the following words, forming three lines, FELICIS AMVLLI GEMELÆ: another has the word ΠΑΝΦΙΛΙ: another cut in form of a heart, with the inscription, BASILEI SEXIS TERT. Some have inscriptions at full length, others only monograms. There are others in the collection of Mr Douce; one in intaglio, engraved on stone, with which a Roman oculist marked his medicines; and another of metal, in cameo, containing the name of the Roman tradesman who used it, TITUS VALAGINI MAVRI. Many more specimens will be found in the antiquities of Father Montfaucon, Franciscus Gori, and others, who have treated on this subject.

State of th art amongs our Britis and Saxo ancestors.

With regard to the state of the art amongst our British and Saxon ancestors, little is known. Like other savage nations, they possessed the art of making rude incisions on their warlike instruments, as the remains found in their ancient tumuli sufficiently testify; and their coins are evidently impressions from engravings cut on iron or steel. Under Alfred the Great, the art seems to have met with great encouragement; and, accordingly, it attained to very considerable perfection in the making shrines and caskets for the reliques of saints and other pious uses, which are said to have been wrought in gold, silver, and other metals, adorned with engravings and precious stones, and to have been the admiration of all that saw them. There is still preserved in the museum at Oxford a valuable jewel, richly adorned with a kind of work resembling filigree, in the middle of which is seen the half-figure of a man, supposed to be St Cuthbert. The back of this curious remnant of antiquity is ornamented with foliage, very skilfully engraved.

Dunstan, Archbishop of Canterbury, is said to have practised both designing and engraving, as well as the working of images and other things, in gold, silver, and brass. However, from the specimen that remains of his skill in drawing, preserved in an ancient manuscript in the Bodleian Library at Oxford, we must be allowed to doubt of the great talent in this way ascribed to him by his monkish biographers.

New spe of the ar on brass plates fo tombs.

Some time after the conquest, a new species of engraving was introduced into England, in every respect different from the work of the chaser or carver, namely, in engraving brass plates on the tomb-stones in churches. They were executed entirely with the graver, the outline being first made out, and the shadows produced by strokes crossing each other, and cut deeper according to the strength of shadow intended, precisely in the way that copperplate engraving is executed at this time. Being usually laid flat on the stones to which they belonged, they formed part of the pavement of the church; and so being exposed to the feet of the congregation passing over them, they were necessarily executed in a coarse manner, and the strokes very deeply cut into the metal. There are some of these that often display very considerable talent in the artist.

eals on recious ones.

The art of engraving seals on precious stones or gems, which was practised by the ancients, and carried by them to the greatest perfection, was probably the invention of the Egyptians; but of the means that were used to carve such hard substances, from the stupendous hieroglyphics which are seen at the temple Tentera, and other places, down to the numerous minute gems which formed personal ornaments, rings, signets, &c. we dare hardly hazard a conjecture. It is supposed that the corundum stone, or adamantine spar, was the substance employed for the purpose by the Egyptian lapidaries; and Pliny informs us, that the Romans used to import sand from Ethiopia and India for this purpose, which it is probable was no other than the grit or powder of the corundum stone. The earliest gem engravings of the Egyptians are in intaglio, consisting most commonly of a grasshopper, a scarabee, or an ibis, and in all probability executed before the invention of letters.

Earliest Greek engravings.

The earliest Greek engravings are likewise scarabees, and, in point of drawing, little superior to the Egyptian hieroglyphics, and strongly attest their origin: they are only distinguished from them by the addition of the names on the several gems, inscribed in the early Greek character. The art of gem engraving kept pace in Greece with the progress of sculpture; and by the time of Alexander the Great, it had arrived at the greatest perfection. While it declined under the successors of Alexander, it migrated to Sicily and Etruria, and there shone in undiminished splendour; but at Rome it never attained to any excellence, except in the hands of Greek artists. During the middle ages it was lost with the other arts, and was afterwards revived in the fifteenth century by John of Florence, and after him kept up by Dominic of Milan; but it has never in modern times regained its ancient perfection.

Origin and progress of the art among the moderns.

We have thus given a slight sketch of the art of engraving in the various ways in which it was practised by the ancients: It now remains to consider its origin and progress among the moderns, in its more important application of delivering impressions upon paper, from plates of metal and blocks of wood, by means of the printing or rolling press.

Printing or rolling press.

The honour of this invention is equally claimed by the Germans, Italians, and Dutch; but as the pretensions of the latter are by no means supported by any satisfactory evidence, they are not entitled to our consideration.

Brief malers.

The art seems to have originated in Germany, in the *brief malers*, or makers of playing cards, who cut their figures on blocks of wood, stamped them on paper, and at first coloured or illuminated them with the hand; but afterwards performed the operation in a much more expeditious manner, by blocks cut for the purpose, each colour requiring a separate stamp. The carvers of the blocks were called *formschneiders*, *i. e.* cutters of forms.

As the mania for the adoration of images of the saints was, at this time, (the beginning of the 15th century,) carried to a most extravagant height, it occurred to the *brief malers*, that the public superstition might be made a source of considerable emolument to themselves. This led them to the cutting of images, and the representations of pious subjects, which were cut and illuminated like the cards, and illustrated with a title of the subject, or appropriate passages from legends, executed on the same block, in the Gothic characters then in use; these were vended for the edification and amusement of the unlettered, and those to whom written books were not accessible.

Impressions of plates first taken about 1423.

Baron Heincken discovered, "in the Carthusian monastery, at Buxheim, near Memingen, a print of St Christopher carrying the infant Jesus over the sea; opposite him is a hermit lighting him with his lanthorn; and behind him is a peasant, with a sack on his back, climbing to the top of a hill." This piece is of folio size, engraved on wood, and illuminated in the same way as playing cards, accompanied with an inscription at the bottom: Christoferi faciem, die quacunque tueris. Illa nempe die morte mala non morieris. Millesimo cccc°xx° tercio. This curious print was found pasted on the inside of the cover of an old book; and there being no reason to doubt its authenticity, it proves that this method of engraving and printing was practised as early as the year 1423. This print was purchased by Earl Spencer some years ago, and is now in his possession. M. Heincken likewise informs us, that, in the convents in Franconia, Suabia, Bavaria, and the Austrian countries, he found many early specimens of works of the same sort, which had been intended for the laity, and had been preserved by the monks, by attaching them to the inside of books.

These detached plates were soon followed by whole series, consisting of many plates, mostly in folio, printed under the name of legends, in which the figures of the saints differ little from each other, or from their prototypes, the figures on the cards. They are illuminated in like manner, and leave no doubt by whom they were executed, and are sometimes accompanied with passages of considerable length.

Poor Man's Bible.

Amongst the books of images without text, there are still preserved in the libraries of the curious, several copies of the *Historiæ veteris et Novi Testamenti*, called also the Poor Man's Bible. Each plate contains appropriate sentences, or the names of the persons, sometimes at the top, sometimes at the bottom, or in scrolls in the middle, all in Latin. At the top and bottom are the busts of two saints, or prophets, with their names under them. In the middle are three historical subjects, that in the centre a principal one, and on each side one typical of it. We shall describe the first plate of this series, which will afford a fair specimen of the whole: it has the annunciation in the centre; the inscription above is *Ecce Virgo concipiet et pariet filium*; on the one side are Eve and the serpent; and below, *vipera vim perdit, sine vi pariente puella*; and farther down, on a scroll, *porta hæc clausa erit, et non aperietur*. In like manner, on the other side, is Gideon with his fleece; above, on a scroll, *descendet dominus, sicut pluvia in vellus*; below, *rore madet Vellus, pluviam sitit arida tellus*; lower down, *creavit dominus*; and, at the bottom, the indication of the principal subject, *Virgo Salutatur, innupta manens gravidatur*. This work contains about 50 plates. There is likewise an edition of this work, with plates somewhat different, with the inscriptions translated into the German language. There still exist copies of other similar works, such as *Historia, seu providentia Virginis Mariæ ex Cantico Canticorum*, and *Historia Beatæ Mariæ Virginis, ex evangelistis et Patribus excerpta et per figuras illustrata*. These led to books of text, illustrated with images, and still engraved on one block, and in all probability the work of the *brief maler*, but printed only on one side of the paper; but in some examples the leaves are pasted together two and two, to look as if printed on both sides.

Origin of prints and books.

First book printed about 1450.

In these works of the *brief malers*, we see the origin both of prints and books. But though they practised this art for a long time, the important uses to which their invention might be extended did not occur to them, till, about the year 1442, Guttenberg of Strasburg, a man of a bold and speculative disposition, seeing these works, imagined, that, by cutting each letter separately, he would be able to print whatever he chose; in this, however, he was not successful, till, after incredible labour and expence, in conjunction with Faust, he found means to form them of metal, with punches and matrices, and produced, about the year 1450, an edition of the Bible, the first book ever printed with moveable types, which, for beauty of execution, even at the present advanced state of the art, excites the wonder and astonishment of all who have seen it.

Engraving on wood.

The art of engraving on wood began by degrees to assume a higher character. William Pluydenwurff and Michael Wolgemuth are the first engravers on wood, whose names are preserved. They executed conjunctly, the plates of the Nuremburg Chronicle, which was published in folio in the year 1493. They consist of figures of various sorts, views of towns, &c.; they are cut with much boldness and spirit; and the characters of the heads are often well delineated. They are, however, marked with all the stiffness and inaccuracy of drawing, which characterise the works of the German artists of that time.

Albert Durer.

In the works of the *brief malers* we see nothing but rude outlines, in the lowest style of art, (if it be at all entitled to the appellation,) without any attempt at correctness of drawing, expression, or effect. The artists who followed, who seem to have been numerous, attempting to give their works a little more finish, by introducing shadow, and paying some attention to drawing, brought the art nearer to perfection than it had yet been; and the completion of it was ultimately effected by the genius of Albert Durer, who, as far as regards the executive part of it, brought it to a perfection which has hardly been equalled by any succeeding artist.

It does not appear that Pluydenwurff ever engraved on copper; but as at this time, with the exception of him, it was the practice of the engravers to exercise both arts, we defer the few criticisms we mean to offer on their works, till we come to the history of copperplate engraving; and accordingly, in bringing it down to our own times, we shall take occasional notice of those who have distinguished themselves in engraving on wood. In concluding this part of the subject, we may remark, that it has been practised at different periods, both by painters and engravers, in every country where the fine arts have been cultivated since their revival, principally in those imitations of drawings called chiar' oscuros, (of which we shall presently take notice,) as well as in the engraving vignettes, decorations for books, and mathematical diagrams; for these purposes it is well calculated, as the block can be inserted along with the text, and printed at the same time. This application of the art has been brought to the greatest perfection by Mr Bewick of Newcastle, who, in his two works, the history of birds and of quadrupeds, at the head of each article has given a representation of the animal of which it treats, in a style which, for tastefulness of design, beauty, and delicacy of execution, have never been equalled, and their value is still further enhanced by their truth of representation.

Mr Bewick

In chiar' oscuro.

Engraving in chiar' oscuro is a method of imitating slight drawings, by means of different blocks of wood.

The Italians ascribe the invention of this branch of the art to Ugo da Carpi, a painter and engraver, born at Rome about the year 1486; but as we have many specimens of chiar' oscuro by the German masters, of a date much anterior to the time assigned by the Italians of its invention by Ugo da Carpi, particularly by Mair, dated 1499, and one by Lucas Cranach, 1500, we cannot admit that he was the inventor. In justice, however, to the claims of Ugo, it must be allowed, that the methods employed by the German artists differed materially from his. The former made out the outline and deep shadows by engraving them on copper, and then laid a middle tint over the whole by impression from a block of wood, cutting out the places where the clear light was intended to be left; while that of Ugo was performed entirely by different blocks of wood, one for the outline and dark shadows, another for the lighter shadows, and a third for the middle tint. Although the number of blocks was generally three, yet, in some instances, four and even five were used. Papillon (*Histoire de la Gravure en Bois*) gives a specimen of the process, consisting of four blocks, an impression of each of which is given separately, as well as one of them all in conjunction. It will be found at the 154th page of the second volume, to which we refer the curious reader.

On plates of metal.

The art of engraving on plates of metal, for taking impressions on paper, seems first to have been practised by the German goldsmiths, whose profession was at that time intimately connected with the arts of painting and sculpture. The earliest specimens which we have with dates, are those mentioned by Professor Christ, (*Dictionaire des Monogrammes*,) one 1465, others 1466, and 1467. These are all without names, and the works of the several artists being only distinguished from each other by monograms, and logogriphes or enigmatical symbols, (which has occasioned much obscurity and confusion,) their names are totally unknown to us; but there are many other prints without either date or monogram, which, both from their design and execution, prove the existence of the art at a much earlier period.

Martin Schoen.

The first artist whose name we are acquainted with, is Martin Schoen, a painter, engraver, and goldsmith. He was born at Culmbach in the year 1420, and died at Colmar 1486. His plates were executed between the years 1460 and 1486. They are very numerous, and, making the necessary allowance for the age and country in which he lived, and the disadvantages he laboured under, he must be allowed to be a man of strong mind and fertile imagination; though his figures have all the meagre taste and bad drawing of that time, his heads are well conceived, and the whole is executed with much mechanical skill. The taste of his design shews the infancy of that branch of the art; yet the beauty of his execution displays a more advanced state in the mechanical part of the art of engraving. He is said to have been a pupil of Stoltzhirs, (an artist of whom we have no well authenticated work;) according to others, of Francis Stoss, to whose style that of Schoen bears a great resemblance, though it must be allowed it is greatly improved.

If we admit that Schoen's preceptor, whoever he was, practised the art ten years before him, it places its origin as far back as the year 1450, ten years before the time fixed by Vasari for its Italian origin.

so Fini- rra.

On the authority of Vasari, the Italians ascribe the invention to Maso, or Thomaso Finiguerra, about the year 1460; and this may be correct with regard to Italy: for it is very possible, that the art of engraving might have been practised long in Germany without the Italians being acquainted with it, as, except between Venice and Antwerp, there was at that time little intercourse between the two countries. It is, however, remarkable, that no sufficiently authenticated print of Finiguerra has ever been produced, although Mariette of Paris, and others, have made diligent enquiry on the subject. It is, however, probable, that, amongst the old anonymous scraps of foliage and grotesque ornaments, undoubtedly the work of Italian goldsmiths, there may be some productions of this artist. There likewise remain two small pieces of this sort marked with a monogram, consisting of the letters M. F. somewhat similar to one of those used by Marc Antonio Raimondi, but the execution of the plate is in a very different style. This has been by some presumed to signify Maso Finiguerra; but it must be considered only as conjecture.

eynheym l Buck-

It is remarkable, that the first book printed at Rome, which also contained the first engravings executed there, (which were only maps,) was begun by Sweynheym, and on his death finished by Buckink, both Germans, as the dedication to Pope Sextus IV. indicates: *Magister Conradus Sweynheym, Germanus, a quo formandorum Romæ librorum ars primum profecta est,—— mathematicis adhibitis viris, quemadmodum tabulis äenis imprimerentur edocuit;*" and that on his death, "*Arnoldus Buckink, e Germania —— ad perfectum opus succedens —— perfecit.*" This work is dated 1478, but it appears that it had been begun as early as 1472. The plates are executed with great labour, and the letters are struck with punches by the blows of a hammer. From this it appears, that if Finiguerra did invent the art of engraving in 1460, it was kept a profound secret for eighteen years afterwards.

ccio Bal- i.

The next book that appeared in Italy with plates, was a copy of Dante's *Inferno*, published at Florence by Nicollo Lorenzo della Magna, in 1481, embellished with thirteen engravings by Baccio Baldini, from the designs of Alessandro Boticelli. Fac similes of two of these will be found in M. Heineken's work; and although the design of the figures is more pure and simple than that of their German cotemporaries, and the draperies cast with tolerable ease, yet the style of execution is puerile and awkward, without any of the delicate finishing which characterises the works of the Germans even of that early period, and is another strong presumption of the justice of the claims of the latter to the invention of the art.

In tracing the history of the art, we cannot withhold from the Germans the precedence to which they seem justly entitled. We shall accordingly begin with the masters of that school.

rman ool.

Of Martin Schoen, and his predecessors, we have already made mention. The works of his brother Bartholomew, bear a strong resemblance to those of Martin, but without his neatness or expression. After them came Israel van Mecheln, Pluydenwurf, Wolgemuth, and Mair, the inventor of chiar' oscuro engraving.

But Albert Durer was the first that attempted to reform the taste of his country, from the rude and barbarous style that was then practised. He displays a fertile imagination, and a preciseness of design, but without grace; and, with regard to his execution, if we do not discover in his plates the boldness and freedom which are desirable in large historical works, they at least display every thing requisite for subjects more minute and finished. Although the art of engraving has since had the advantage of the experience of three centuries, it would be difficult to find a more perfect specimen of executive excellence than his print of St Jerome, engraved in the year 1514. He is supposed to have been the inventor of the art of etching: his works executed in that way are the earliest extant; they are not equal to his engravings, but his wood cuts are free and masterly. Although he was acquainted with the anatomy of the human figure, and designed it occasionally with correctness, his contours are neither graceful nor pleasing; and his figures and drapery are never entirely divested of the formal Gothic taste prevalent at that time. His plates are numerous, and much esteemed.

German school.

What we have said of the style of Albert Durer, applies in general to his pupil Aldegrever, Hans Sebald Beham, and his brother Bartholomew, Aldtorfer, Binck, Goerting, George Penz, and Virgilius Solis, who, from the small size of the greater number of their plates, are generally distinguished by the name of the "little masters," although they have likewise executed large ones. Hans Holbein, a native of Augsbourg, or, according to some, of Basle, an eminent painter, executed several engravings on wood. The most remarkable, are those called "the Dance of Death," consisting of fifty-three small prints, the first publication of which took place about the year 1530.

The German school long continued to produce engravings both on copper and wood, principally illustrations of books; but as from this period it does not seem to have possessed any artists, whose works deserve particular consideration, and as the characteristics which distinguished it begin to disappear, from the artists going to Rome for the sake of improvement, we shall not prosecute the subject further, but proceed to the Italian school, from whence every thing that is great and excellent in modern art has emanated. Generally speaking, they drew correctly, but they seem to have been more anxious for emolument than fame, if we may judge from the prodigious number of Bible cuts, and religious subjects, executed by them, which have all the appearance of having been done with great rapidity.

Italian school.

After Boticelli and Baldini, already mentioned, Andrea Mantegna, and Antonio Pollajuoli, practised the art. Mantegna, by his superior knowledge of design, contributed more to its perfection than all his cotemporaries in the style of his engraving. He has a great resemblance to Pollajuoli; but in the drawing of his figures he greatly surpasses him, particularly in the naked. Their plates are generally executed with single strokes, in a diagonal direction, without hatching or cross lines; in the manner of drawings done with a pen. Giovanni Maria di Brescia, and others, followed the manner of Mantegna, without however making any improvement in the art. But Beccafiumi, without much neatness of handling, produced several works, both etched, and with the graver only, which display the talents of a great master. We have likewise by him, as well as by Andrea Andreani, many prints in chiar' oscuro, a branch of the art which they carried to greater perfection than it had reached before them. The drawing is correct, and the execution neat and spirited.

Marc Antonio.

The appearance of Marc Antonio forms the most brilliant epoch in the history of Italian art. He was born at Bologna about the year 1488, and there commenced his studies as a painter under the tuition of Raibolini, an artist of considerable celebrity at that time. In these he appears to have made great progress. It is not known under whom he learnt the art of engraving, but it is probable that it was from some one of the goldsmiths of that day. His first engravings are the four heroes, and his Pyramus and Thisbe, dated 1502, taken from the designs of Raibolini.

Being desirous of improving himself by travelling, he went to Venice, where he first saw the works of the German engravers, particularly a set of wood cuts by Albert Durer, representing the life and passion of Christ. These he copied with such accuracy on copper, that they were often sold for the originals; which coming to the knowledge of Albert, he came to Venice, and instituted a prosecution against him for the piracy before the senate.

The excellence of Roman design, which, by the genius of Michael Angelo and Raffaelle, aided by the disinterment of the *chef d'œuvres* of ancient art, and the magnificence of the Medici, had now reached its acmé, attracted Marc Antonio to Rome, where his merit soon recommended him to the notice and friendship of Raffaelle, who employed him to engrave from his designs under his own eye, and is said (though without sufficient evidence,) to have assisted him in correcting the outlines on his plates. The first plate which he executed from the design of Raffaelle, was *Lucretia stabbing herself*; and in it he seems to have exerted all his abilities to make it neat and delicate: and soon after, the plate of *the judgment of Paris*; a work possessed of much more spirit and freedom. His engravings after Raffaelle are very numerous, and are all marked with that correctness of scientific delineation, and beauty of character in his heads, which distinguish his works, and which place him, in this respect, in the highest rank of engravers of any age or nation.

The style of Marc Antonio, however, possesses none of the blandishments of smooth delicate execution, to which his German contemporaries had attained in so eminent a degree. His manner is dry and unattractive, without any attempt at the representation of local colour, or the charms of chiar' oscuro, or reflected light.

Among the many young Italian artists whom the reputation of Marc Antonio had attracted to Rome, for the sake of his instruction, the following may be named; Agostino de Musis, Marc da Ravenna, Giuglio Bonasoni, Nicolo Beatrici, and Enea Vico. His school was likewise frequented by several artists from Germany, such as Bartholomew Beham, George Penz, James Binck, and many others.

Marc Antonio, during the lifetime of Raffaelle, devoted himself almost exclusively to engraving the works of that master; but on his death, which happened in 1520, he executed several plates from the works of Giuglio Romano, and amongst others a set of lewd subjects, accompanied with verses from the pen of the poet Aretino. This so highly offended Pope Clement VII. that he was cast into prison, from whence he was with great difficulty released at the intercession of Cardinal Giuglio de Medici and Baccio Bandinelli, the sculptor. In gratitude to the latter of these, he engraved, from a picture of his, the famous print of the martyrdom of St Laurence; in which, the drawing of the naked (which he corrected) is excellent, the draperies are ample, and the character of the heads well expressed: qualities much greater than can be looked for from the reputation of Baccio Bandinelli. The last dated print we have of him is the battle of the Lapithæ, 1539.

After Marc Antonio, the credit of Roman art was well maintained by his pupils, whom we have already mentioned, as well as by Georgio Ghisi, better known under the name of Mantuanus, his sister Diana, and their relations, Giovanni Battista and Adam Ghisi; though in none of the higher excellencies of the art has he ever been equalled by any of his successors. Agostino de Musis introduced, in a few of his engravings, the method which has since been called *Stippling*. It had been occasionally practised as far back as Martin Schoen and Albert Durer; the latter of whom employed it in imitating the texture of beaver hats, &c. Agostino perceiving that it was peculiarly expressive of softness and delicacy, executed flesh with it. A specimen of his method will be found among his works, in a small plate of an old man seated on a bank, with a cottage in the back ground: in this, the face of the figure is entirely stippled with the graver; but this occurs in his works only in one or two instances.

Cornelius Cort.

The art of engraving had been hitherto nearly confined to small plates; but Cornelius Cort opened the way to a more important walk in the art. He was born at Hoorn, in Holland, in 1536. It is probable he was first instructed by Jerome Cocke; but after having engraved a considerable number of plates from the Dutch and Flemish painters, he went to Italy. He first settled at Venice, where he resided in the house of Titian, and engraved some of the finest works of that great painter. He afterwards established a school at Rome, where he executed those admirable works after Raphaelle, and others of the Roman school, which are much sought after by the judicious collector. The plates of C. Cort are wrought entirely with the graver, in a bold, open, and masterly manner, and display more freedom of execution than had been attempted before. The drawing is correct and tasteful; and his back grounds, particularly his landscapes, are managed with great skill and address.

This style was imitated by Henry Golsius, who introduced it into the Low Countries, and laid the foundation of that great excellence which we admire so much in the works of Bolswert, Pontius, and Vosterman. This period, when the transcendent beauties of the Roman and Florentine schools of painting were thus so successfully diffused by the talents of Marc Antonio, and his immediate successors, marks the true era of the perfection of Italian engraving; for soon after this time, the capabilities of the art began to develope themselves, for displaying the charms of chiar' oscuro, the delicate texture of human flesh, and, to a certain extent, the beauties of local colour. Its professors gradually relaxed their efforts in the rugged and difficult paths of design, to follow the more flowery and attractive pursuits, which depend on freedom and dexterity of execution; but the higher excellencies of the art have never been entirely lost sight of by the Italian school, and they have shone forth with great splendour in our own times, united with all the beauties which the experience of so many centuries has so fully perfected, as the works of Cunego and Volpato abundantly testify, and still more, those of Raffaelle Morghen, and some of his pupils.

The art of engraving and etching was likewise cultivated with much success by most of the Italian painters. Titian etched many landscapes in a slight and spialian hool.

rited style; and there are also attributed to him several large engravings on wood. Parmeggiano etched several plates, which are valuable for the spirit and grace that he has displayed in them; however, from their very defective execution, he seems to have been totally ignorant of the processes employed, and he has accordingly been considered as the inventor of etching, though we knew that it was practised long before by Albert Durer; yet it would appear, that he was either ignorant of its prior discovery, or that he only learned it imperfectly by report. There are many chiar' oscuro engravings said to be by him, but it is more likely that they were executed by Ugo da Carpi, or Andrea Andreani, under his direction. As an engraver, Agostino Caracci must be ranked amongst the most celebrated artists of Italy. The correctness of his design is only equalled by the beauty of his execution; and his plates would have nearly reached perfection, if he had paid more attention to the representation of *local colour*, and the effect of chiar' oscuro, (a neglect of which, however, was the prevalent defect of that age): The lights are, therefore, too much scattered, and left untinted, both on the front and principal objects, as well as in the distances, which not only destroys the harmony of the effect, but gives a slight unfinished appearance to the neatest engraving. His heads are remarkably fine, and the extremities are marked in the most accurate and masterly manner. He studied engraving under C. Cort, to whose works the style of Agostino bears a great resemblance, and, like him, he worked entirely with the graver. We have likewise several plates by the rest of the Caracci, which possess all the beauty and correctness of design, as well as freedom of execution, which characterise their school. They are mostly etched first, and touched up with the graver afterwards; but, as they did not dedicate so much attention to engraving as Agostino, they are not so highly finished.

gostino aracci.

Stefano Della Bella.

The etchings of Stefano Della Bella, a pupil of Cantagallina, born at Florence 1610, are marked with the character of excellent taste. No artist has ever surpassed him in the delicacy and spirit with which he has handled the point; and his plates have a clear and brilliant effect. They are often slight, which is not surprizing, when we consider that their number amounted to more than fourteen hundred. His works are generally of a small size, and consist of every variety of subject,—portraits, history, landscapes, and animals. Callot, who was also a disciple of Cantagallina, though born at Nancy in Lorraine, must be considered an artist of the Italian school. The fertility of invention, and the vast variety which are found in the works of this excellent artist, is truly astonishing. The talent he possessed of combining an amazing number of figures, and of varying their attitudes, without forced contrast, so that all, whether single figures or groupes, may be distinguished from each other even in the shadows, was truly admirable, particularly when we consider the extreme minuteness of many of them. He generally (especially in his large prints) raised the point of sight to a considerable height, in order to afford more ample room for his figures, and greater scope to his invention. In that charming print called *The Punishments*, the number of figures he has introduced is astonishing, all of them disposed in different groupes with the greatest judgment; and the actions of even the smallest of them, in the distance, are conspicuous, though the largest figure on the foreground scarcely exceeds three-fourths of an inch. The same may be said of his *Fair*, and many others. The subjects which Callot and Della Bella chose for their works, are nearly similar; but the excellence of the former consists in the clearness and perspicuity of his designs, the arrangement of his groupes, and the firmness of his outline; while that of the latter consists in the freedom of his point, and the lightness and elegance of his figures.

Italian school.

Spagnoletto.

The etchings of Spagnoletto (born 1589) are bold and free; his lights are broad and clear, and have a powerful and pleasing effect. He drew correctly, and the extremities of his figures are marked in a masterly manner. The characters of his heads are admirably expressed, particularly of his old men, which he was fond of introducing into his compositions. Guercino, (born 1590,) as an engraver, has left only two memorials behind him of his talents, a St John and a St Antony of Padua. They are executed with much spirit and freedom, in a style resembling his admirable drawings with a pen, which have been imitated so poorly by Pasqualianus, and in our own time by Bartolozzi in a very superior style, from drawings in the collection of his present Majesty. Salvator Rosa has left many etchings, both history and landscape. In these we must not look for the grace and interesting delicacy of Corregio or Guido, nor the scientific design of the schools of Rome and Florence. His figures in general represent banditti; and his landscape, the wild and savage grandeur of Alpine scenery. His style is slight but masterly; his heads are admirable, but the legs and other parts of the naked are incorrectly drawn. His draperies are stiff, and ill cast, and the whole destitute of elegance: however, the masses of light are finely preserved; and his landscape is sublime.

Guercino.

Salvator Rosa.

Claude Lorraine.

In the department of landscape, Claude Lorraine first claims our notice. He has left about 28 landscapes, though in general in rather a slovenly style of execution. They display great intelligence of the chiar' oscuro, and have, to the eye of the judicious critic, an admirable effect. One of the most characteristic excellencies of his pictures, is the beauty, grace, and fine diversity of character in his trees; and these qualities he has transfused into his etchings with unparalleled success. One of these landscapes, in particular, may be mentioned, on the right side of which, in the middle ground, is a groupe of trees, and seen through the opening the ruins of an ancient temple, in which the richness and diversity of character, and the truth of nature, we hesitate not to say, have never been equalled. His subjects are the same as he represented on his canvass, landscapes with ancient ruins, rivers, and sea views, embellished with shipping, figures, and cattle. The etchings of his pupil Swaneveldt, which are very numerous, are executed with much spirit and effect. They are in general well composed; but though they possess much of the truth of nature, and great neatness of finish, they bear no comparison with those of Claude.

There are many beautiful etchings of the Italian landscape painters, as well as by French and other foreigners, who, studying in Italy, or forming their style on the Italian models, must be considered as belonging to that school, such as Gaspar Poussin, Milé, Glauber, Both, Rousseau, Sebastian Bourdon, Meyering, &c. But as the peculiarities of each will be better understood by an inspection of their works, than by any verbal description, we shall not enter on any further details on the subject.

Canaletti.

The etchings of Canaletti, however, are executed in a manner so different from any thing that had been done before him, that we cannot forbear taking particular notice of them. They are all architectural subjects, or views of streets, &c. principally in Venice: they display a great intelligence of perspective, and a fine sparkling effect of light, accompanied with a freedom and boldness of execution, which is hardly to be seen in the works of any other artist.

Many engravers have distinguished themselves by an elegant detail in their lights, whilst the parts in shade have been left in a state of comparative neglect and obscurity. Canaletti is remarkable for the distinctness and detail which appear throughout the whole of his compositions, not only in the parts receiving the clearest light, but in those also which are under the deepest shade.

French school. Noël Garnier. The first French engraver that we have on record, is Noël Garnier, who lived about the middle of the 16th century. His manner is very Gothic, and appears like the work of a goldsmith. He executed a great number of initial letters for books, ornamented with figures and foliage. After him flourished Stephen de Laulne: his works are very numerous. They are in general small. He copied many of the prints of Marc Antonio with much success; but his engravings are mostly from his own designs. They are executed with the graver only, and have great merit. **Claude Mellan.** Claude Mellan introduced a new method. He expressed all the varieties of shadow by parallel lines without crossings, the greatest depth being given by only strengthening the lines, and consequently bringing them closer to each other; and the effect he produced is clear, soft, and agreeable. The number of his plates is very considerable, among which there are many admirable portraits. The most singular of all his productions is a print called the Holy Handkerchief, or Sudarium of St Veronica, executed with one spiral line, running in concentric circles from the point of the nose to the extremity of the work, with the motto, "*formatur unicus una*," representing, as large as life, the head of Christ, crowned with thorns, on a piece of linen. This print is not remarkable for any excellence of character or design; we adduce it solely as a specimen of his dexterity in the use of the graver, and the whimsical use to which he, in this instance, applied it. He died at Paris in 1688. But the most brilliant epoch of French engraving was the time of Louis XIV. when the magnificence of the monarch, aided by the taste of his minister Colbert, produced such a constellation of artists as had never before appeared at one time. **Gerard.** The most distinguished of all these were Gerard Edelinck, and Gerard Audran. Though the former was born at Antwerp, he must be considered as belonging to the French school, as the splendid works on which his fame rests were all executed at Paris, where he settled. This extraordinary artist wrought entirely with the graver; and his execution, which is both spirited and finished, discovers neither labour nor littleness, negligence nor mediocrity; and his heads are distinguished by the most lively expression. He was an accomplished master of what is called colour in engraving. He excelled both in history and portrait; many of his plates are of a large size, and very numerous, evincing a most surprising facility. **Gerard Audran.** Of the family of the Audrans there were six eminent engravers; but the most conspicuous is Gerard, born at Lyons in 1640. He carried the art to the highest pitch of perfection, particularly in his large plates of historical subjects. The immense plates of the battles of Alexander, after Le Brun, and his works after N. Poussin, and other Italian masters, are a lasting monument of his talents. The other artists of his family were all men of talents; and though none of them equalled Gerard, the numerous works they have left are an honour to their country.

Nanteuil. Nanteuil, who applied himself exclusively to the engraving of portraits, certainly of all his contemporaries is entitled to the highest rank; and his works are considered as the first productions of that department of the art. His style, in clearness and beauty of effect, have never been surpassed. Although he died at the age of 48, the number of his plates is very great; all of them in a most finished style. **The Drevets.** In this department, the Drevets likewise hold a distinguished situation. There were three of this name. Peter Drevet the younger, is the most eminent of the family. His works are executed with the graver: though they have been surpassed in boldness and freedom, they have hardly been equalled in the beauty of his finishing, and the clearness of his stroke. His celebrated portraits of Bossuet and Samuel Bernard, are considered the finest specimens of that style of engraving. **Le-clerc.** The style of Leclere is different from all the preceding. The versatility of his talents is only equalled by the industry and success with which he exerted them. Besides his historical subjects and portraits of a large size, he executed an incredible number of small pieces of temporary interest, such as processions, triumphs, as well as architecture, landscapes, perspectives, and medals. In his best prints, the forms of his figures are elegant and correct: their draperies simple and well adapted to them, and the expression of his heads noble and characteristic; and the landscapes, buildings, and other accessories, are executed with great taste. He generally advanced his plates with the point, to a state which left the graver only to give them more harmony and depth of effect; and if his execution is inferior to Della Bella in the playful charm of the point, it possesses a judicious firmness, suited to the higher subjects he has engraved. The number of his plates amounts to nearly 3000.

There were many other artists of eminence at this time, such as Chereau, Cochin, Simonneau, Beauvais, Dupuis, &c. but of these our limits do not permit us to enter on any particular details.

Balechou. Balechou, born 1715, carried the handling the graver, as far as relates to the clearness of the strokes and brilliancy of colour, to a greater perfection, than any preceding artist of his country; but, notwithstanding the beauty of his execution, his flesh is like marble, and his drawing is lame and incorrect. These defects appear most conspicuous in his historical subjects and portraits; but his three landscapes, after Vernet, are amongst the finest productions of the graver.

Wille. Wille, a native of Germany, but who resided mostly at Paris, and flourished about 1760, carried the excellencies, which we have ascribed to Balechou, still farther. No engraver, since his time, has ever equalled him in the clearness of his cutting, and the beauty and smoothness of his effect; and his style was admirably adapted to the subjects he chose, which were in general the conversations, and other familiar subjects of the Dutch and Flemish painters. He imitated sattin with astonishing success. His print of the death of Cleopatra, after Netscher, affords a wonderful example of this. She is habited in white sattin; and though we must condemn the taste which dictated such a costume in such a subject, every one must admire the talents which its execution displays. The flesh in this, as well rench hool.

as most of his other works, is hard, and like marble, from the excessive clearness of his lines.

e Bas.

The landscapes, cattle pieces, and drolls of the Flemish and Dutch schools, have been rendered with much fidelity and spirit by Le Bas. He availed himself much of the freedom and facility of etching, which he harmonized in an admirable manner with the dry point and the graver. He executed upwards of an hundred plates after Teniers, besides numerous engravings from Ostade, Wovermans, du Jardin, Berghem, and others of that school.

From the brilliant era of the age of Louis XIV. to the present time, the French school has distinguished itself for all the mechanical excellencies of the graver; but it is to be regretted that these qualities, after the time of Edelinck and the Audrans till within these few years, have seldom been displayed on subjects of legitimate historical composition, but have in general been confined to the representation of the most absurd and ridiculous frivolities.

avid.

The genius of David, and a concurrence of other circumstances, have revived the study of the antique, and effected a total revolution in the national taste; but in leaving the one extreme of folly and affectation, they have gone to the other, that of cold insipidity. Their historical subjects now, in aiming at the chaste and rigid style of the antique, present nothing but groupes of statues, without life, energy, or action. Of this sort are all the works of the present French engravers, though possessing all the beauties of mechanical skill, in which they have so long excelled.

lemish id Dutch hools.

The Flemish and Dutch schools now demand our consideration; and as the styles of them both differ not materially from each other, we shall include them both under the same head.

ucas Jaobs.

Lucas Jacobs, better known under the name of Lucas Van Leyden, must be regarded as the patriarch of the Dutch school. He was born in 1494, and was contemporary with Albert Durer. There existed between them the most cordial friendship. He is allowed to have surpassed Albert in composition, though inferior to him in design. His drawing of the figure is stiffly taken from the model, without grace or elegance in the style, which was at that time prevalent in his country. His execution is neat and clear; but as his stroke is equally fine in the fore-grounds as in the distances, and as there is a want of connection in the masses, his plates, though extremely neat, are inferior in firmness, harmony, and effect, to those of Albert Durer: He engraved on wood as well as copper, but his cuts are not numerous. They are spirited and masterly.

After the death of Lucas Van Leyden, the art seemed to have made little progress for many years, as the engravers seem to have been principally employed, as in Germany, in decorations for books.

ie Wieixes.

The Wierinxes, who flourished about 1580, and who imitated the style of Albert Durer, with the exception of correct drawing, and much attention to the marking out the extremities of their figures, did little towards its advancement.

ie Saders.

The family of the Sadelers, at Brussels, made at this time a conspicuous figure. They drew correctly. Their earlier works have much of the German taste; but this they in a great measure laid aside when they visited Italy; we speak here more particularly of John and the elder Raphael Sadeler, as the younger branches, Giles or Ægidius, Justus, and the younger Raphael, had the benefit of the instructions of their uncles. Their works are multifarious, consisting of history, landscape, and portraits; the latter of which are in general very fine, and much esteemed.

Flemish and Dutch schools.

There were in the Low Countries at this time many other artists, whose works display great talent; the elder and younger Peter de Jode, Philip, Theodore, and Cornelius Galle the elder, who all drew correctly; but as with them engraving was more an article of commerce than an art which was to be cultivated and improved for its own sake, it received little advantage from their exertions.

Bloemart.

Cornelius Bloemart introduced a new style, which was the source from which the great engravers of the French school derived the principles of giving so much colour and harmony to their works. He tinted the lights on his distances, and other parts of his plates, with great care, which, till his time, had been uniformly left entirely untouched. By this improvement, he laid the foundation of those principles of colour and chiar' oscuro, which form so essential a requisite to breadth and unity of effect, and have in later times been practised with so much success.

Goltzius.

The art received another important improvement from Henry Goltzius, who, on his return from studying at Rome, despising the neatness and stiff dry manner of the little masters, introduced the bold, free, and clear style of cutting, which distinguish his works. He possessed a most profound knowledge of the figure, and drew correctly; but, in avoiding the formal style of his countrymen, and endeavouring to imitate the sublimity of Michael Angelo, he, as well as Spranghér, fell into the opposite extreme of bombastic absurdity and extravagance. However, he has never been surpassed, and hardly ever equalled in the freedom and dexterity of handling the graver. He engraved small portraits with much taste, neatness, and good drawing. He also cut, from his own designs, many blocks in chiar' oscuro, in which he was very successful. The outlines are executed with all the freedom and dexterity for which he is so remarkable; and the works which he has produced in this way are truly excellent. He was followed by his disciples John Muller and Lucas Kilian, who carried his style to a greater pitch of extravagance than his preceptor had done. But it was imitated with more judgment by Mathem and Saenredam, whose works display more delicacy and correctness.

The brilliancy and splendour of Rubens afforded a new object for the imitation of the engraver, for which the improvements of Corn. Bloemart and Goltzius had prepared the way.

The Bolswerts, &c.

About the beginning of the seventeenth century, flourished the two Bolswerts, whose first exertions were in the style of Goltzius; but under the instruction of Rubens, they improved their style. Of this school, Paul Pontius, Vosterman, the younger Peter de Jode, and others, make a distinguished figure, principally in their engravings after Rubens and Vandycke. They all drew correctly, and have been very successful in rendering the harmony and beauty of the originals. But after the death of Rubens, the art of engraving gradually declined, and ceased to produce, in the higher department of the art, any specimens worthy of our attention. But in the departments of landscape and animals, and such subjects, in which the Dutch and Flemish schools excelled, there are many beautiful etchings, executed principally by the painters.

Rembrandt.

In considering this part of our subject, we cannot withhold from Rembrandt the pre-eminence to which his works so justly entitle him; they consist of history, landscape, and portraits. His drawing of the human figure is very bad; his heads are all of a low and vul-

Vertue.

George Vertue, born 1684, a scholar of Michael Vandergucht, was one of the most industrious artists that this country has ever produced. He has left a numerous collection of portraits, many of them very respectable, many book cuts, Oxford almanacks, and antiquities of all kinds; and he made many drawings in water colours, with the view of engraving them. We are likewise greatly indebted to him for his Lives of the English Artists, a work for which he was indefatigable in collecting information, as well as in procuring portraits of the artists. The manuscript work came into the hands of the Hon. Horace Walpole, who revised and published it. It abounds in much curious and interesting information, and is well known. He died 1756.

Pond and Knapton.

We have several works executed with great spirit and taste, in a very artist-like manner, the productions of Arthur Pond and George Knapton; among others, a set of plates, in imitation of chalk, and washed drawings, from the designs of the great Italian masters: some of these are in chiar'oscuro, with etched outlines. They flourished about the year 1740.

Vivares.

The first artist of any school, who has been completely successful in rendering with the truth, spirit, and character of the originals, the landscapes of the great Italian masters, (not even excepting Edelinck and Audran, in their beautiful works in this way,) is Francis Vivares: he was a native of France. It appears that he did not apply himself to the arts till he was considerably advanced in life. He learned the principles of the art from Chatelain in London; but being a man of great genius, he improved on the style of his preceptor, and acquired such freedom in etching as had never been possessed before by any engraver: the foliage of his trees is delicately and lightly expressed; and his effect is deep, broad, and clear. His finest works are from the pictures of Claude Lorraine, and possess infinitely more of the character of the originals than those of any other engraver.

He must be considered as the founder of the English school of landscape engraving, and although (except by Woollett) he has never been equalled, the light which he gave to succeeding artists has been the means of keeping up that decided superiority in this department which this school possesses above every other. He brought his plates to a state of considerable finish and effect with the point, and put the last touches on them with the graver.

Woollett.

The landscapes of Woollett stand unrivalled for beauty of execution, and may be considered the most perfect models of style for landscape. Like Vivares, he carried his plates a considerable way with the point, and gave them the necessary depth with the graver, touching them up in the more delicate parts with the dry point. His works have all the delicacy and clearness of the French masters, and with all the spirit and taste of Vivares. He likewise executed several historical plates and portraits with great success. His chief works are the large landscapes, which he has engraved from R. Wilson, and others; the Death of General Wolfe, after West; and a small portrait of Rubens, after himself. In tracing the progress of this branch of the art, we cannot withhold our admiration from these two great men, who, from the state of total insignificance and neglect in which they found it, raised it at once to such dignity and perfection. The earliest landscapes we have of any importance from the works of the great painters, are the engravings of Bolswert, after the pictures of Rubens. They are executed with his usual ability, in the large broad style which distinguishes his historical works; but, being entirely with the graver, give a very inadequate idea of the character of the foliage, the quality of surface of the several objects, or the brilliancy and splendour of Rubens. The large set of landscapes by Audran, after Nicolo Poussin, exhibits a nearer approximation to the true style of landscape, than those of Bolswert, being executed in a style of much greater delicacy; but, from the unmanageable nature of the graver for such subjects, with which they are entirely executed, they are still very defective in character and spirit. The landscapes of Balechou, which are unrivalled for clean cutting and dexterity of handling the graver, display a most erroneous conception of the true object of art, and afford, notwithstanding their astonishing mechanical excellencies, very imperfect representations of the aërial nature of clouds, the liquidity of water, or the richness and variety of nature in the foliage of trees. The discrimination of Vivares and Woollett pointed out the defects of their predecessors; and, more particularly in the works of the latter, we find all the truth of nature united to all the beauties of mechanical skill.

Browne.

John Browne is another eminent engraver of landscape of this time. He has executed several large works after S. Rosa, Both, and other great masters, in an excellent style. He likewise etched many of the plates which were afterwards finished by Woollett with the graver.

Sir Robert Strange.

From this period, the English school is prolific in artists in every department. In history, the first name that we ought to mention is that of Sir Robert Strange. He is admirable for the breadth of his effect, and the beauty of his execution; but his great excellency is the delicacy and softness of his female flesh. In this last, notwithstanding the perfection that modern art has arrived at, in all those great qualities which result from mechanical skill, he has never been equalled by any master, as his engravings from the works of Titian, Guido, Correggio, and the other painters of the Italian schools, sufficiently show; but it is deeply to be regretted that, with so many excellencies, his drawing should be so incorrect, particularly in the extremities. Of the other artists who have excelled in history, we have only room to mention a few names; Legat, Basire, Hall, Ryland, Bartolozzi, Heath, Holloway, and many others of our cotemporaries, who maintain, with distinguished success, the respectability of English art.

In the engraving of portrait, the English school, for a century back, has produced little in the line manner, which in this way has been almost entirely superseded by mezzotinto; and, more particularly in small portraits, by stippling. The method of mezzotinto is admirably adapted for portraits, especially in the imitating of the bold, broad manner, of the English style, which originated in Sir Joshua Reynolds, and has ever since been the distinguishing characteristic of this school. We have many good portraits by the earlier artists, such as Faber, M'Ardel, Smith, Williams, and others; but, in the portraits of Earlom, Watson, V. Green, &c. after Reynolds, we see the art carried to the utmost perfection. In stippling, or the chalk manner, the artists and their productions are innumerable, and of very different degrees of merit, principally of a small size for books. We have, however, many beautifully executed in the chalk manner by Bartalozzi, Holl, Collyer, and others; but there is perhaps none superior to those of Caroline Watson, who has produced, among many others, that head of Sir J. Reynolds which forms the frontispiece to

Watson.

raving.

his works, and which, for spirit and effect, is hardly surpassed by the works of any artist.

lish
ol.

In landscape, besides Vivares, Woollett, and Brown, whom we have already mentioned, we have many fine works, principally from the pictures of the old masters, by Byrne, Mason, Wood, Elliott, Lowry, Wilson, Major, Earlom, and others; but, of late years, the taste for embellishing books with subjects of topography and antiquities, having been carried to a most extravagant height, has diverted the current of British genius from the more dignified province of heroic landscape, and absorbed all the talent of the English school; which, (without depreciating the true value and interest of such works), would have been more worthily employed in translating the works of Claude Lorraine, Poussin, R. Wilson, and some of the eminent artists of the English school.

uatinta
raving.

dby.

Engraving in aquatinta, which was invented by St Non, and communicated to Le Prince of Paris about the middle of last century, was brought to England, and greatly improved by Sandby. It has been carried to great perfection by our cotemporaries, in imitating Indian drawings; and the process, being simple and expeditious, and of course well adapted to commercial purposes, has been much practised. The English painters have produced few etchings that merit our attention; and what they have executed, are chiefly on the soft ground, or on stone, the separate processes of which will be found detailed at the end of this article.

rlom.

Mezzotinto has been likewise employed with the greatest success in imitating the effect of drawings, as is exemplified in that excellent work by Earlom, called the *Liber Veritatis*, being a collection of 200 plates from the drawings of Claude Lorraine, in the collection of the Duke of Devonshire. The brilliancy of the effect has been rendered in an admirable style with the mezzotinto, and the outline added with much truth and spirit, with etching.

imbach
d Bur-
t.

In the department of drolls and conversations, till the appearance of Wilkie, the English school never produced any thing; but, in the engravings of the Village Politicians by Raimbach, and the Blind Fiddler by our countryman Burnet, from the pictures of that master, we see specimens of British talent which rival the beautiful works of Le Bas after the pictures of Teniers.

ogarth.

The works of Hogarth exhibit a walk of art untrodden before him. The Dutch and Flemish schools had carried the representation of local manners to great perfection; but Hogarth added to this a dramatic and didactic character, strong and poignant satire, and epigrammatic point. "I consider that great and original genius," says Lord Orford, "rather as a writer of comedy with a pencil, than as a painter. If catching the manners and follies of an age, 'living as they rise,'—if general satires on vices, familiarised by strokes of nature, and heightened by wit, and the whole maintained by proper and just expressions of the passions, be comedy, Hogarth composed comedy as much as Moliere. In his *Marriage à la Mode*, there is even an intrigue carried on through the whole piece. He is more true to character than Congreve; each personage is distinct from the rest, acts in his sphere, and cannot be confounded with any other of the *dramatis personæ*. The alderman's footboy, in the last print of the set I have mentioned, is an ignorant rustic; and if wit is struck out of the characters in which it is not expected, it is from their acting conformably to their situation, and from the mode of their passions, not from their having the wit of fine gentlemen. Sometimes he rose to tragedy, not however in the catastrophe of kings and heroes, but in marking how vice conducts insensibly and incidentally to misery and shame. He warns against encouraging cruelty and idleness in young minds, and discerns how the different vices of the great and of the vulgar, lead, by different paths, to the same unhappy end. The fine lady in *Marriage à la Mode*, and Tom Nero in the *Four Stages of Cruelty*, terminate their story in blood: she occasions the murder of her husband; he assassinates his mistress. It is seldom that his figures do not express the character he intended to give them. When they wanted an illustration which colours could not bestow, collateral circumstances, full of wit, supply notes. The nobleman in Marriage à la Mode has a great air, and the coronet on his crutches, and his pedigree issuing from the bowels of William the Conqueror, add to his character. In the Breakfast Scene, the old steward reflects for the spectator. Sometimes a short label is an epigram, and is never introduced without improving the subject." His plates are numerous, and have all the expression and character of his pictures, and are executed with great boldness and spirit. His drawing, though not correct, is almost sufficient for the subjects which he excelled in. It is to be regretted, that his ambition prompted him, in an evil hour, to aspire to the rank of a historical painter—a walk of art in which, from his previous pursuits, and the peculiar nature of his talents, (great as they were), he was by no means qualified to excel. He painted several pictures in this way, which display the greatest ignorance of the requisites essential to this branch of the art; and are completely destitute of good taste, correctness of design, colouring, in short of every quality which is considered indispensible in such subjects. He has likewise engraved them, and in a style which, though happily suited for those subjects on which his fame rests, have turned his history into caricature.

Different
kinds of en-
graving.

There are various kinds of engraving, as has already been seen; but that which is performed with the graver is the oldest, and to it, in common language, the term *engraving* is often exclusively applied, in contradistinction to etching, mezzotinto, or any other method.

The improvements of modern art have given a degree of importance to the etching-needle, which the older masters did not acknowledge: and, accordingly, works of every description, from the largest historical plates to the smallest vignettes, are, with it, brought up to considerable effect, and finished to the necessary depth with the graver; the lights on the more delicate parts being tinted with the dry point.

Instru-
ments used
in engra-
ving.

The principal instruments used in stroke engraving, are, the graver or burin, of which there are various sorts; a scraper, a burnisher, and a cushion for supporting the plate.

The graver is an instrument made of steel, of the form of a quadrangular prism, about one tenth of an inch thick, increasing a little in thickness as it approaches the handle, which is made of wood. In making the incision, it is pushed forward by the hand in the direction of the line required, and held at an angle very slightly inclined to the plane of the copper. It is obvious, that it must be performed with only one (the lower) angle of the tool, and the point is formed by bevelling off the end of the instrument.

The burnisher is about three inches long, is used to soften any of the lines which are cut too deep, as well as in the preparation of the copper.

The scraper is an instrument of steel also, about six inches long, tapering to a point, having three sharp edges. It is used to scrape off the barb that is formed by the action of the graver. In order to shew the appearance of the work as it goes on, and to polish off more completely the barb, a roll of felt or woollen cloth, called a rubber, is used for rubbing the part of the plate with a little olive oil.

A cushion, being a leather bag of sand, of about nine inches diameter, was formerly used to lay the plate upon, to allow it to be turned in any direction; but this is now never used, except by the engravers of writing.

Ruling machine.

For engraving a series of parallel lines, which are all either equidistant, or approximating towards each other in regular gradation, from a great to the most minute distance, such as in the blue part of a sky, water, or in plates of machinery, &c. where a smooth flat tint is required, an apparatus called the ruling-machine was some years ago invented by Mr Wilson Lowry of London. The accuracy of its operation is perfect, and the beauty of the execution is unequalled by any thing that has ever been performed in any other way. It is performed on the etching ground by a point or knife connected with the apparatus, so as to move with unerring certainty, and bit up in the usual way with the aquafortis. This instrument will be elsewhere found minutely described: (See Ruling Machine). There are numberless specimens throughout this work of the productions of this machine, and we may mention at random, Plates CC. and CCI. to which we refer the reader.

Wood engraving.

In wood engraving, the block is commonly made of pear-tree or box, and differs in thickness according to its size. The surface for the engraving is on the transverse section of the wood: the subject is drawn upon it with a pen and Indian ink, with all the finishing that it is required to have in the impression. The spaces between the lines are cut away, with knives, chisels, and gouges, leaving the lines that have been drawn with the ink.

It will be seen, from this, that the taking impressions from blocks of wood differs from that of copperplate in this, that in the latter they are delivered from the incision, while in the wooden block they are delivered from the raised part.

In looking at the works of the old German artists, from the time of Albert Durer down to Christopher Jegher, we are surprized at the frequent occurrence and freedom of execution of the dark cross hatchings—an operation which, by the common process of cutting away the interstices, could not be done but with the greatest labour, and certainly without the freedom which those artists have displayed.

As many of the impressions exhibit unequivocal evidence of being worm-eaten, every doubt is removed of the nature of the material on which they have been wrought. We are therefore irresistibly led to the conclusion, that those parts, instead of being cut with the tool, have been executed by some chemical process, in some degree analogous to etching on copper, by corroding the interstices instead of the lines; and it has been suggested to us by an eminent artist of this city, Mr W. Lizars, that this might have been accomplished by sketching in the work with any bituminous substance capable of resisting the action of acid, such as the common etching-ground, (see Etching), rendered fluid by solution in oil of turpentine, put on with a pen or hair pencil, and the rest afterwards corroded. We have likewise seen several works in this way, portraits and sketches of all sorts, executed by Mr D. Somerville, wherein he has introduced these crossings with the utmost freedom and delicacy. His method he does not choose at present to divulge, as he intends making it the subject of a publication.

Chiar' oscuro engraving.

The method of chiar' oscuro engraving, the history of which we have already given, is performed with three blocks. The outline is cut in one, the deep shadows in a second, and the third gives a tint over the whole, except where the lights are cut away. See Papillon, *Histoire de la Graveur en Bois*.

Etching.

Etching is performed by covering the plate entirely with a ground capable of resisting the action of aquafortis. The design is made with a black-lead pencil on a piece of paper of the same size, which being moistened for some time in water, and laid on the plate with its face next the etching-ground, and run through the rolling-press, leaves a distinct impression on it, which is partially transferred from the paper. The operation of the needle then takes place, which is performed by scratching with the point the lines in the different directions, and crossing them according to the effect required. The thickness of the lines, which is regulated by the quality and distance of the object, will be varied by the size of the point of the etching-needle, being greater or less according to the purpose for which it is intended. The corrosion with the nitric acid is performed by making a wall round the plate of what is called bordering wax, in order to contain the aquafortis, which is then poured over it, and allowed to remain on it according to the depth that the work may require. It may be then touched up with the dry point, or deepened, if necessary, with the graver, having previously cleaned off the ground with turpentine.

The etching with the dry point is performed on the plate, without any ground, solely by the point of the needle; and the barb which is raised by the operation is taken off by the scraper.

Etching with the soft ground is a method of making imitations of black-lead or chalk drawings. The ground is mixed with a proportion of tallow or hog's-lard, according to the state of the weather. A piece of thin paper is put over the plate, and attached to it at the four corners by a little turner's pitch. The design is then made out on the paper, and shaded to the necessary degree of effect with the black-lead pencil, and the action of the pencil on the paper takes off the ground from the copper at the same time; and when finished, it is bit to the requisite depth in the usual way. The details of the various processes will be found more minutely detailed in the article Etching.

Stippling.

Stippling, or the chalk manner, is performed likewise on the etching ground, by dots instead of lines made with the etching needle; which are made closer and thicker, according to the depth of the shadow. A small wheel, consisting of many points diverging from its centre, and revolving on its centre, and fixed on a piece of steel wire inserted into a wooden handle, is sometimes used; by moving this backwards and forwards, the points mark the copper, and give an excellent imitation of the freedom of chalk-drawing. The work is then bit with the aquafortis in the usual way.

Williams' process.

Another method of etching has just been discovered by Mr H. W. Williams, and Mr R. Stein of Edinburgh: it is performed by instruments totally different from the etching needle; the beauty and richness of its effect is only equalled by the rapidity with which it is executed. Although the inventors have not as yet prosecuted their discovery as far as it is obviously susceptible, yet what they have produced shews that it is capable of much variety of application. The specimens consist mostly of landscape and sea views; the skies, which are executed with minute parallel lines, have all the delicacy and smoothness of aquatinta; the water is perfectly liquid and transparent, and the rugged character of the rocks, and other objects in the foreground, is admirably expressed. The process they do not mean at present to communicate, but a volume of the specimens they will shortly publish.

Engraving on steel. Engraving on steel is principally employed for cutting signets, punches, matrices, and dies proper for striking coins and medals. The engraving of the device of the punches is performed in relievo, according to a model in wax; and when finished, it receives a high temper, in order to stand the blows of the hammer in striking the matrix. The steel of the matrix is made hot to soften it, that it may more easily take the impression of the punch; and when struck, is touched up where there are any deficiencies, by means of graving tools, chisels, &c. The mouldings of the border, engrailed ring, letters, &c. are then struck with small steel punches, well tempered, and very sharp.

Etching on steel. Etching on steel is performed by drawing the design with Brunswick black, laid on with a hair pencil. It is then bedded in glazier's putty, or the bordering wax used for etching, and the aquafortis poured over it, and suffered to remain till it be bit to the requisite depth. It may then be poured off, and the black cleaned away with a little turpentine.

Mezzotinto engraving. The method of mezzotinto is performed by first laying a ground on the copper, by roughening the whole surface with a serrated or toothed instrument, and moved in various directions, till it be brought to such a state as to be capable, if an impression were taken from it in this stage of the process, of giving a flat black tint to the whole. The outline is then traced with an etching needle. The lightest parts are then scraped to the greatest smoothness; and the middle tints are also produced in the same manner, by scraping them, so as to leave a greater or less portion of the ground, according to the depth required.

Engraving on stone. Engraving on stone, is a method of imitating pen and ink drawings, for which the inventor some years ago obtained a patent. It is performed on a slab of marble, or some close-grained stone. The design and effect is made out, with a pen dipped in a solution of lac, in the ley of pure soda, with a little soap, and coloured with lamp black.

When the drawing has been on the stone for three or four days, or when the ink is perfectly dry, it is soaked in water. In this state it is daubed with printer's ink from the balls, and the ink will adhere to the design and not to the stone. The impression will be taken from it in the same way as letter-press printing, by putting a sheet of damp paper over it, and subjecting it to the action of the printing-press.

Another method. Another method of engraving or printing on stone was invented by Alois Senefelter, a native of Prague in Bohemia, who obtained an exclusive privilege for it from the Elector of Bavaria, in 1801; and, in 1803, a like privilege from the Emperor of Austria. He accordingly established stone printing-houses at Munich and Vienna; and, under his direction, similar establishments were formed in France and Italy: but it is at Munich that the art has been brought to the greatest perfection. It has been found well adapted for imitation of wood-cuts, drawings, music, all kinds of writing, and geographical maps.

The method is to take a calcareous stone or slab of marble, with a good polish, of from two to three inches thick, and of a size proportioned to that of the work to be executed on it. The design, notes, or letters, are marked out with a solution of gum lac and potash, coloured with lamp black. When they are dry, the stone is covered with aquafortis; and the acid attacking all parts of the stone except those which have been impregnated with the resinous ink, the drawing remains untouched, and appears like the block of a woodcut. When the acid has corroded to a sufficient depth, the slab is washed with clean water, and, while wet, printing-ink is applied to it with balls in the usual way, and put through the rolling press. At each proof, the block must be washed with water. This method, for expedition, cheapness, and durability, has greatly the advantage over the usual processes, particularly for music; and it is said, that, at the stone printing office at Vienna, thirty thousand impressions were taken off the same slab, and the last impressions were nearly as good as the first.

Etching on glass. Etching on glass is performed by laying on a ground consisting of a thin coat of bees-wax, and making out the design with an etching needle. It is then covered with sulphuric acid, and sprinkled over with pounded Derbyshire spar (fluor spar). It must be taken off after four or five hours; and when cleaned with oil of turpentine, the etching will appear, leaving what had been covered with the wax untouched. By this method, glass vessels are graduated, or ornamented.

This process is sometimes reversed, by putting on the design or ornament with a solution of bees-wax in turpentine, and exposing the ground to the action of the acid, which, when sufficiently corroded, will leave the ornament untouched, and the ground deprived of part of its polish and transparency. It is to be observed, that the sulphuric acid does not *immediately* act on the glass, but only by expelling one of the constituent parts of the spar, (the fluoric acid,) so that the effect of the corrosion will be according to the quantity of the fluoric acid evolved, acting on the glass; and as it possesses much greater activity in the gaseous state than when combined with water, the operation will be performed more expeditiously by exposing the plate to the action of the gas as it evolves, properly secured to prevent its escape; and in this way, several plates may be bit at once.

Seal engraving. Seal-engraving, which is performed both in cameo and intaglio, was an art much practised by the ancients. It was performed on all sorts of precious stones, but onyx was the most commonly used for this purpose. The operation is performed by inserting the tools into the axis of a small iron wheel, which is attached to an apparatus like a turner's lathe, and kept in motion by the foot. The tools are tightened by a screw, and the stone to be engraved is applied by the hand to the tool as it revolves, and is shifted and conducted as required. The tools are generally of iron, and sometimes of brass; their forms are various, generally resembling chisels and gouges: some have small round heads like buttons, others flat, &c.; and when the stone has been engraved, it is polished on wheels of hair brushes and tripoli.

See Strutt's *Dictionary of Engravers*; Bryan's *Dictionary of Painters, Engravers, &c.*; Landseer *on Engraving*; Heineken *Idée Generale d'une Collection complette d'Estampes*; Vasari *Vite de' Pittori*; Orlandi, *Abecedario Pittorio*; Christ. *Dictionnaire des Monogrammes*; Papillon *Histoire de la Gravure en Bois*; Felibien *Principes de l'Architecture et des autres Arts qui en dependent*. (P. G.)

ENHARMONIC Change, in music, is the occasional substitution, during performance, of one interval for another, differing therefrom, in a slight degree, in order to avoid that departure from the original pitch, which is called Divergency *of Tune*, (see that article.) The Rev. Henry Liston, in his valuable work, entitled *An Essay on perfect Intonation*, p. 72, after giving an extract from Huygen's *Cosmotheorios*, remarks, that the pitch, in singing, or on his organ, &c. cannot be preserved by slightly tempering every interval, but must be effected by substituting other notes, in particular situations; and, at page 120, he shews also, how, when the musician, by a series of dominants, has wandered away from his principal key, may recover his lost ground, while he seems to the hearer to be persevering in the same course, by only substituting a particular note, either higher or lower, by a *schisma*, by a major, or by a minor *comma*, than the one that is written, in the ordinary notation of music, and in which enharmonic changes are all marked in his improved mode of writing music for the performer, on perfect instruments.

Enharmonic *Degree* of Aristoxenus, or Diesis *quadrantalis*, is an interval, equal $\frac{1}{4}$th of a major tone, or $\frac{1}{4}$T; $=25.9271353\Sigma+f+2m$, or $26\Sigma+\frac{1}{2}f+2\frac{1}{4}m$. Some authors have called this the quarter tone major, and Mr Hoyle denominates it the enharmonical diesis.

Enharmonic *Degree* of Euclid, is an interval three-thirtieths of the minor fourth, or $\frac{1}{10}\times$ 4th, $=25.92674\Sigma+f+2m$, and its common log. is $=.9875061,2634$.

Enharmonic *Diesis*, (greater δ,) or *diesis greater* of the mean-tone system, (see Vol. VII. p. 739,) is an interval whose ratio is $\frac{128}{125}$, or $\frac{5^3}{2^7}$, $=21\Sigma+2m$ in Farey's notation, $=.9897000,4336$ in common logs. $=.0102999,5664$ in recip. logs., $=.0342153$ in Euler's logs., $=1.9091591$ in major comma logs., $=21.0157248$ in schisma logs. In tuneable intervals it is VIII—3 III, =2VIII—3-6ths, =4th—2 III+3, by either of which methods of ascending and descending, or *vice versa*, in the tuning process, on an euharmonic organ of Liston's, this interval may be tuned above or below any given note; already it will be found tuned thereon, above ※D, E, ※G and ※B, respectively.

In the symbols explained in Plate XXX. Vol. II. the following equations will be found to express the exact relation of this interval to all the other intervals therein, viz.

δ=c + Є
=Σ+2Є

Ɛ= R+π
=21Σ+2m

Ɛ=R+χ +ḋ
=π +F +5Σ
=ḋ +m+9Σ

δ=S—𝒮
=S—𝔖
=2 — 𝒮
=S— I
=L— 𝒻
=I — ∂
=ʃ—c

Ɛ=𝒮—π
=𝔖— ∂
=𝒻— 𝔎
=∂ — 𝒻c
=2S— t
=T — 2𝔖
=t — 2𝒮

δ= 2c — Σ
= 3c — ḋ
= VIII — 3III

Ɛ= 2ḋ — 3Σ
=2VIII—3-6th

Ɛ=21d+63f—19m
= c + φ — f
= π + R — d
= Є + ḋ — Σ
= c + ḋ — 2Σ
= π + c — 𝒻c
= 𝒻 + Σ — 𝒻c
= ḋ + D— 𝒻c
= ∂ + f — R
=11Σ+ m — Є
= 𝒻 + R—Є

Ɛ=𝒻 +c —π
=𝒮 +Є—𝒻
=L +c —𝒻
=S +c —𝔖
=𝒮 +ʃ—𝔖
=S +c—P
=T +Є—t
=T +Є—T
=t +ʃ—T
=T +ʃ—T
=4th+3d—2III

Ɛ=2π—2r—5Σ
= 𝒻—χ— Σ
= 𝒻—r —2Σ
= ʃ—Є— Σ
= 𝔖—𝒻— Σ
= P—𝒮— Σ
= P—ʃ—𝒻c

Ɛ= t — S—∂
= T—2𝒮—c
= T— 𝒮—𝔖
= T— S—∂
=2T—2t — Σ
=3T—3t — ḋ

In that almost endless diversity of nomenclature, in which theoretical writers on music have indulged, this interval, besides the above, has received the denomination of *apotome* by some writers; *apotome major* by Salomon, Boethius, &c.; *buothius* by Rameau; *comma* by Chladni; (see Comma, Vol. VIII. p. 19.) *comma greater* by some writers; *diesis* by Euler, Liston, &c.; *diesis minor* by Holder; *diese major* by Rameau; *diminished second* by Liston; *harmonia* by Hamfing; *quarter note* by Boyce, Holder, &c.; *quarter tone* by several; *tierce wolf* by Earl Stanhope, &c. It is the error (♭) of the trumpet, and French horn minor sixth.

Enharmonic *Diesis* (lesser) of the mean-tone system, (see Vol. VII. p. 739.) occurs adjacent to the half notes of that system of temperament, is an interval equal $17\frac{3}{4}\Sigma+f+1\frac{1}{4}m$, $=17.8937641\Sigma+2m$, whose common log. is .9912224,3171.

Enharmonic *Diesis* of Aristoxenus, is one quarter of the major tone, $\frac{1}{4}$T, or his Enharmonic *Degree*, which see.

Enharmonic *Diesis* of Euclid, one-tenth of the minor fourth, or $\frac{1}{10}\times$4th, or his Enharmonic *Degree*, which see.

Enharmonic *Ditone* of Aristoxenus, is an interval less than a minor fourth by half a major tone, $=$4th$-\frac{1}{2}$T $=202\Sigma+4f+17\frac{1}{2}m$, $=202.0039312\Sigma+4f+17m$; its common log. .9006375.2462.

Enharmonic *Ditone* of Euclid, is an interval 24-30ths of the minor fourth, or $\frac{4}{5}\times$ 4th, $=203.20471\Sigma+4f+17m$, whose common logarithm is .9000460,1671.

Enharmonic *Genus* of the Greek music. See Genera.

Enharmonic *Interval* of Geod and Gregory, is the *Major* Comma $\frac{81}{80}$, which see.

Enharmonic *quarter of a Tone* of Rameau, is the Enharmonic *Diesis* $\frac{128}{125}$, which see. (ε)

ENTOMOLOGY.

Entomology. Definition.

Entomology, from ἔντομα, *an insect*, and λόγος, *a discourse*; the science which treats of insects, a class of animals, which were formerly arranged, along with Crustacea and Arachnides, under the general denomination of insects (Insecta,) which, as we have already shown under the article Crustaceology, are now universally allowed to be distinct. The word ἔντομα is derived from ἐν, *into*, and τέμνω, *to cut*; and *insectum* has a similar root, from *in*, into, and *seco*, to cut, because insects are divided into numerous segments, or from their being generally almost divided into two parts, which are merely attached to each other by a slender thread. The former term was made use of by Aristotle, who lived about 500 years before the Christian era, and seems to have been known much earlier than his time. It is defined by him to signify an animal which, by incisions, is severed into two or more parts. The latter word, *insectum*, is adopted by Pliny, and was in use among the Latins long before his time, and we find it applied in the same sense as the ἔντομα of Aristotle.

Importance of the science.

As the animals of this class constitute the most considerable portion of animated beings, it becomes one of the most interesting and important sciences which can engage the mind of the philosopher. The extreme difficulty of discriminating the characters and particular affinities of these beings, arising from their number and variety of form, in addition to their minuteness, more strongly claims his consideration. He who neglects the study of insects, or thinks it beneath his notice, cannot deserve our respect, as a general observer of nature, nor be considered a scientific naturalist. The views of such a man will be partial, and his inquiries circumscribed; he regards only an inconsiderable portion of animated nature; and he confines his remarks to such as, from their size and distinctness of character, present the least obstacle to investigation. In the study of entomology, the man of science will find abundant scope for the exercise of his zeal. The amazing number of species; their curious forms, so infinitely varied, and yet so nearly and gradually approximating through an endless series of transitions from one species to another; the diversity of structure observable in those parts which afford generic characters, added to the wonderful changes in form which they undergo, with their surprizing economy,—are circumstances which contribute to render them objects of most curious speculation to the philosopher. And although the study of every class of animals is most indisputably attended with peculiar advantages, yet we shall venture to affirm, that it is from a knowledge of the characters, metamorphoses, and various modes of life, these little animals are destined to pursue, that he will obtain a more intimate acquaintance with the great laws of nature, and veneration for the Great Creator of all, than can be derived from the contemplation of any other class in nature. Many other attractions accompany the study of this department of science. The beauty of insects in general, renders them engaging to many who have neither time nor inclination for studying their more complicated structure; and the gaiety of their colours, often combined with the most graceful forms, displays a beauty, splendour, and vivacity, greater than that bestowed by the hand of Nature on any of her other works. One defect in appearance must indeed be conceded; and this may be regarded, in point of beauty, a material defect; they are not always so considerable in magnitude as to become, even with these embellishments, so strikingly attractive. Were they equal in size to the smallest birds, their elegance would render them more inviting in the eyes of mankind in general; but, even amongst the minor species, when examined with a microscope, we find their beauty and elegance far superior to that of any other class in nature. "After a minute and attentive examination," says Swammerdam, "of the nature and structure of the smaller as well as the larger animals, I cannot but allow an equal, if not superior, degree of dignity to the former. If, whilst we dissect with care the larger animals, we are filled with wonder at the elegant disposition of parts, to what a height is our astonishment raised, when we discover these parts arranged in the least in the same regular manner!"

Uses of entomology.

Insects may be divided into two kinds; those which are immediately or remotely beneficial or injurious to mankind. Many insects certainly seem not to affect us in any manner; others, and by far the greater number, most assuredly fall under one or the other denomination, and surely on this account demand our most serious attention; but, lest our allusion to the utility of some insects should seem hypothetical to the superficial observer, whilst the noxious effects of others are too obvious to admit of doubt, we shall be more explicit in this observation. The depredations of insects upon vegetable bodies, are often detrimental; but it must be remembered, that in these ravages they often repay the injury they commit. The locust, the most destructive of all insects, whose numbers spread desolation through the vegetable world, are not (except on some occasions when their multiplication exceeds all bounds) unproductive of advantage. Although they deprive mankind of a certain portion of their vegetable food, yet, in return, their bodies afford nutriment of a wholesome and palatable kind, and in much greater abundance. The various species of locusts are the common food on which the inhabitants of many parts of the world subsist at particular seasons. The honey of bees, in many warm climates, constitutes another primary article of food. The caterpillars of several moths furnish materials for the silken raiment so universally worn by all ranks in the eastern parts of the world; and hence, in these countries, the silky produce of these industrious little animals is of as much use as the fleecy coat of the sheep is to us. As an object of traffic, silk is one of the utmost importance in China and Tartary; and, in those parts, paper is manufactured from the refuse of the same material. The extensive use of wax in all ages, is well known; but it is less generally understood that all wax is not produced by the bee alone; the wax-insect of China is a very distinct animal: (See Cicada, *Index*; and Donovan's *Insects of China*). Some insects are used with success in medicine; and many others (the cochineal, for instance,) are rendered useful in the arts: and greater numbers might perhaps also be employed for the same purposes. These few, out of a vast many more instances, are sufficient to prove the absurdity of an opinion very prevalent, "that insects are too insignificant to deserve the attention of the philosopher." But allowing these benefits to be unknown, and that the study of entomology is not productive of any substantial advantages, how absurd would it still be to treat such an extensive portion of the creation with neglect? The objection, that they are in nowise conducive to our interests (even if founded in truth), would be no evidence of the frivolity of the science, unless we are to conclude, that the only inquiries which merit our rational attention are those which tend to the gratification of selfishness. If this be admitted as an objection, how many objects of philosophical investigation must be rejected as frivolous! From the earliest period in which the light of natural knowledge dawned, this class of animals has obtained considerable attention; and although the study has not at all times been cultivated with equal ardour, yet we shall hereafter be enabled to prove that it has not been utterly neglected, but has engaged the study of men endowed with talents as splendid, and judgment as refined, as the most exalted of those who affect to treat it with contempt.

HISTORY.

History.

From the earliest period of which any authentic records remain, this science has obtained a very considerable portion of attention; but the total destruction of the great public libraries, has deprived us of the means of ascertaining to what state this branch of science had attained, till within about 2000 years of the present time. We shall now endeavour to lay before the reader an account of these works; and, as we deem the subject of importance, shall, as far as our limits will allow, mention every work, however slight, which has been productive of any material information; at the same time, we wish it to be understood, that we do not consider it necessary, or within our province, to enter at large upon a critical analysis of the multitude of writings before us, but only such as we have had an opportunity of consulting with attention, describing the leading intention of their authors respectively, which we shall enumerate as nearly as possible in chronological order.

Some books appear to have been written prior to the date of those which have descended to us, as we infer from various hints recorded in the earliest of those works now extant.

Moses.

The oldest records on this subject are to be found in the sacred writings, where mention is made of locusts, flies, and caterpillars; and it is probable Moses had acquired a slight knowledge of this science from the Egyptian sages, as his works abound with passages relating to insects; and amongst the obsolete works of Solomon, he is said to have treated of "creeping things."

Solomon.

Hippocrates.

Hippocrates, who lived about 500 years before Christ (as we are told by Pliny), wrote on insects. The writings of the earlier Greek and Latin philosophers, quoted by Pliny, afford extracts of his labours.

Aristotle.

Aristotle flourished in the succeeding age. He wrote, amongst many other works, a *History of Animals*, an elementary book, giving a general and comprehensive view of the animal creation; but he rarely descends to the description of species. It is a work of the greatest merit, which no one can impartially peruse without confessing the intimate knowledge its writer must have possessed of nature. The insect class is treated of in several parts of his work. In the seventh chapter of his first book, we find the term ἔντομα is that of a family, which constitutes one of his four orders of animals with colourless blood. These animals he terms *exsanguineous*; and, in his definitions, he points out, with great accuracy, in what they differ from the other three divisions of this class, viz. *Mollusca*, *Crustacea*, and *Testacea*. In the first chapter of the fourth book, we find the essential characters more clearly given, namely, the incisions on the back or belly, or both, by which their bodies appear to be divided into two or more parts. In another part of his book, more particularly devoted to insects, he describes them as having three parts, the head, trunk, and abdomen: the second part is denominated an intermediate portion, corresponding with the back and breast of other animals. He also adds, they have feet. In subsequent passages, he describes insects which fly, and those that walk. Amongst the former, he notices those with naked wings, and these covered with a sheath; and he observes, that some of these have the sheaths divided, and others immovably connected. The naked winged insects are of two kinds, some with four, and others with two wings. Some of those with four naked wings are furnished with stings at the extremities of their bodies, whilst these with two are destitute of this apparatus. He describes, with attention, the horns (*antennæ*) of the butterflies and locusts. When noticing the legs, he remarks the leaping feet of the locusts, which he compares to those of springing animals. The accuracy with which this learned philosopher has described the various parts of these animals, cannot but astonish the learned entomologist; he will be surprised at their consistency. Their accordance with the entomological definitions of the modern systematists, will excite further comparison; and the natural result will be, that, with the acquired knowledge of 2000 years, so far as he does proceed, we, until lately, have been unable to amend his observations. A cursory perusal of the whole work will show, that whatever might be the merits of this great man, his writings evince too much acquaintance with the science of nature to be the produce of any individual genius, shining with unborrowed light; for, when we reflect on the slow manner in which all human knowledge is developed, we are readily convinced that the science of nature must have made some considerable advancements before his time; and that he has derived considerable assistance from the works of more ancient naturalists.

Ælian.

Ælian, in his work on animals, Περὶ ζώων, appropriates several chapters to insects, without entering into the system at large, confining himself to particular kinds; and those noticed are described with attention, as crickets, the generation of wasps, of cantharides, &c.

Democritus, &c.

Amongst the Greek writers who immediately, or within a few centuries, followed Aristotle, treating on insects, were, Democritus, Neoptolemus, Philistus, Nicander, Herodius, with many others of less note. These writers were probably cotemporary with Pliny; and, during the same period, several Latin writers seem to have been induced to pursue this science, through the influence of the Greeks, who were insensibly led to it from attending to the culture of bees, which at that time was attended to with the most enthusiastic ardour. Aristamachus of Soli is said to have written on the subject, from the result of fifty years experience; and Philiscus to have employed his whole life in forests and deserts attending to their history.

Aristamachus.

Philiscus.

Pliny.

Pliny, in the eleventh book of his *Historia Naturalis*, treats of insects. His observations are chiefly copied from the work of Aristotle. In his day, the culture of silkworms was an object of attention. He says that garments of silk were much admired in his days by the fair sex, as it shewed their form to advantage from the delicacy of its texture.

Titus, &c.

From the time of Pliny till the overthrow of the Roman empire, the study seems not to have been totally disregarded; but we are ignorant what steps were advanced during that period. Amongst the writers were Titus, Ætius, Alexander, Oribasius, Trallian and Paulus Ægineta, who lived between the fourth and seventh century. Between the ninth and twelfth century, some of the Arabian botanists distinguished themselves as entomologists. The principal were Rhazes, Avicenna, Avenzoar, and Averrhoes. From this period till the fifteenth century, a few obscure writers, scarcely worthy of notice, appeared, viz. Myrepsus, Platerus, &c.

Arabian entomologists.

Albertus Magnus.

Albertus Magnus wrote a general zoological work, entitled, *De Animalibus*, part of which treats of insects. He died 1280, but his work did not appear until the year 1519, being printed at Venice.

Agricola.

In 1549, Agricola published his work, *De Animalibus Subterraneis*, which contains a systematic arrangement of insects. He reduces all insects to three principal classes, viz. 1. Those that walk; 2. Those that fly; and, 3. Those furnished with swimming feet; and describes a number of species.

Wotton.

In 1552, Edward Wotton published a work, entitled, *De Differentiis Animalium*, in which he treats largely on insects. The book is in folio, and appeared three years before the author's death.

Rondeletius.

In 1555, Rondeletius of Montpellier gave his valuable work, "*Universa aquatilium Historia pars altera*," to the world, in which he treats of insects, which he accompanies with wood cuts.

In 1599, in folio, was published at Naples, "*Ferrante Imperato dell' Historia Naturale libri 28.*"

Aldrovandus.

In 1602, a very voluminous work was published, entitled, *De Animalibus Insectis*, by the "indefatigable compiler" Aldrovandus. Donovan is inclined to give him considerable credit. He has certainly acquitted himself in collecting together the undigested observations of the ancients; but from his entire ignorance of the subject, he has necessarily fallen into all the errors of his predecessors: we must, however, allow, that he has acted with candour, having rarely omitted to mention his authorities. He was professor of medicine at Bologna, and employed much of his time in the study of insects, and expended large sums of money in acquiring specimens, and employing artists to figure them. He is stated to have paid two hundred florins annually to an artist, who was occupied solely in the delineation of insects. He divides insects into two great orders, 1. *Terrestial*; 2. *Aquatic*, which he terms *Insecta farica*, and *Non farica*: these he divides into sub-orders, from the number and situation of their wings and feet. His figures are but rudely expressed, which is excusable. At this time a taste for more expensive embellishments began to prevail; but as the art of engraving on copper had scarcely emerged from its infancy, these works were exclusively produced by artists themselves.

Wolfang Frenzius.

In 1612, the *Historia Animalium Sacra*, by Wolfang Frenzius, dividing insects into three classes, 1. *Aeria*, 2. *Aquatica*, 3. *Terrea*, and containing several new observations, appeared: and three years afterwards, in the year 1616, at Rome, a pamphlet of about one hundred pages, in Latin, entitled, *De Formica*, by Jeremiah Wilde.

Jeremiah Wilde.

In 1622, a work but remotely relating to insects, in 4to, appeared in Edinburgh, bearing the following title, *Hieroglyphica Animalium Terrestrium, &c. quæ in Scripturis Sacris inveniuntur et plurium aliorum, cum eorum interpretationibus*; which, being the first work relating to insects published in Britain, is not unworthy of notice as a curiosity.

Hoefnagle.

In 1630, a thin quarto, by Hoefnagle, was published under the title of *Diversæ Insectorum volatilium Icones ad vivum depictæ, per D. J. Hoefnagle, typisque mandatæ a Nicolao Johanni Vischer*, containing 326 figures, some of which are very indifferent. He has not adopted any particular mode of arrangement, but contented himself with delineating them in the states presented by chance, not always following them throughout their progressive changes.

Mouffet.

In 1634, Thomas Mouffet published his *Insectorum sive minimorum Animalium Theatrum*, which appears to be the second work on entomology published in our country. This work, as its title indicates, is written in the Latin language; it appeared in London in one volume folio, and contains numerous wooden cuts, rudely executed, accompanied by long, tedious, and often ridiculous and fanciful descriptions of the species. The first seven chapters (*capita*,) are occupied with heavy details concerning the common hive bee (Apis *Mellifica*.) The eighth is entitled, *De Vespis*. The ninth, *De Crabrone et Tenthredine*, which includes the humble bees (Bombi). The tenth, eleventh, and twelfth, *De Muscis*, which includes, with several dipterous (or two-winged insects) many hymenopterous, as well as neuropterous insects. The thirteenth, *De Culicibus*. The fourteenth, *De Papilionibus*, which occupies two hundred pages, the margins being embellished with 112 wooden figures, executed in the rudest style, yet in most instances tolerably intelligible to the skilful entomologist. The fifteenth *De Cicindela*, including the glow-worm (*Lampyris*,) and several others. The sixteenth, *De Locustis*. The seventeenth, *De Cicadis et Gryllis*. The eighteenth, *De Blattis*. The nineteenth, *De Buprestide et Cerambice*. The twentieth, *De Cantharide*. The twenty-first, *De Scarabæis*, which includes many of the larger beetles, (*Coleoptera*). The twenty-second, *De Scarabæis Minoribus*. The twenty-third, *De Proscarabæo et Scarabæo Aquatico*. The twenty-fourth, *De Gryllotalpa*. The twenty-fifth, *De Phryganea*. The twenty-sixth, *De Tipula*. The twenty-seventh, *De Forficula sive auricularia*. The twenty-eighth, *De Scorpio, Formica, et Pediculis alatis*. And, lastly, the twenty-ninth, *De Cimice Sylvestri*. After these, we arrive at the second book, which treats of apterous insects, (those wanting wings), amongst which he places all sorts of *Larvæ* (or caterpillars) of other species belonging to winged insects, and likewise many of the vermes, &c. We must apologise to the reader for taking up so much of his time with dry statements of the heads of this work; but as it was one of the first produced in this country, we trust he will not consider it as entirely uninteresting; and as a specimen of his style and notions relative to insects, we may quote the following, which speaks of a species of *Mantis*, (probably *M. religiosa* or *Oratoria*): "Pectus habet longum, tenue, cuculo tectum, caput simplex; oculos sanguineos, satis magnos, an-

tennas breves, pedes sex locustarum more, sed anteriores multo crassiores longioresque cæteris, quos quia junctos plerumque elevat (precantium ritu) a nostratibus *presque Dieu* dici solet: totum corpus macilentum est. Tam divina censetur bestiola, ut puero interroganti de via, altero pede extenso rectam monstrat, atque raro vel nunquam fallat. Cauda illi bifurca, setaceis duobus aculeis prædita; atque ut nanum elevatione vates refert, ita etiam et motus similitudine; neque enim ludit ut alii, neque saltat, neque gestit; sed lente obambulans modestiam retinet et maturam quadam ostendit gravitatem." The work is professedly an improvement on that of Dr Wotton, begun in 1550, continued by Conrad Gesner; and was afterwards enriched and published in its present form by Mouffet.

Hollar. In 1646, Hollar gained considerable reputation by his work, *Muscarum, Scarabæorum, Vermiumque variæ figuræ et formæ, omnes ad vivum coloribus depictæ et ex collectione arundeliana, &c.* which was published at Antwerp.

Johnson. In 1657, the *Historia Naturalis* of Johnson, in folio, was published; but as this work is a mere compilation, it is unworthy of further notice; for "he has not added a single remark to what was before known."

Topsal. In 1658, an English translation of Mouffet's work was published in London by Topsal, chaplain of St Botolph.

Goedart. Goedart, about this time, published a work in the Dutch language, with plates. This work, considering the time of its appearance, must be considered of considerable merit. It has been translated into Latin, French, German, and English, with copies of the plates. "For the space of twenty years," we are told, "Goedart devoted himself to the study of insects." He followed them through their progressive changes with great precision: this renders his book more extensively acceptable; and his figures, which were never surpassed by his predecessors, are sufficiently correct to be understood. The first edition of this work being sold off, the first volume of a Latin translation, by Dr Mey, minister of Middleburg, was produced, under the title of *Metamorphoses et Historia Naturalis Insectorum,* in 1662. **Mey.** Lister allows but little credit to the translators of his works; "Goedart," he observes, "left his writings in Dutch; his translators were men wholly ignorant of natural history, and their comments are mere rhapsodies altogether."

Power. In 1664, a quarto relating to insects as objects of microscopical investigation, by Power, was published.

Hook. In 1665, Hook's *Micrographia* appeared; and, like the former work of Power, treats of minute insects.

In 1666, was published in quarto, *Adami Olearii Gottorffische kunst-kammer Sleswig.*

Merret. In 1667, *Pinax rerum naturalium Britannicarum, continens Vegetabilia, Animalia et Fossilia, in hac insula reperta inchoatus,* by Christopher Merret, M. D. was published in London. This is the first work treating exclusively of the insects of Britain: it contains a brief catalogue of such as were known to Dr Merret, each being accompanied by a concise descriptive sentence by way of name. In the first volume of the *Transactions of the Entomological Society of London,* an account of the insects given by this author, with their systematic names, is given by A. H. Handorth, Esq.

Charlton. In 1668, Charlton published a work in London, with a systematic arrangement of insects, after the manner of Aldrovandus, entitled, *Onomasticon Zoicon, &c.* 4to.

Swammerdam. In 1669, was printed in Dutch, with a Latin title, at Utrecht, *Historia Insectorum Generalis, &c.* by the illustrious Swammerdam. This work was printed in 4to. (and has since undergone several editions, which we shall mention in their proper order), illustrated with thirteen copper-plates. Many years elapsed before the excellence of this work, the admiration of later times, was in any manner acknowledged. It was condemned as inaccurate until the death of its learned and generous author, affording one of the many examples of that culpable spirit which living merit so rarely fails to experience, for labours bestowed for the benefit of an ungrateful world. No sooner was his death announced, than his merits were discovered, and his work was rendered into French by an anonymous translator: this and many other editions soon after followed. The system of this author is interesting; we shall therefore give a short sketch to our readers. He divides insects into four classes, the characters being taken from their metamorphoses and economy. The first undergo no change, and includes *spiders, onisci, &c.* (which are noticed under our article CRUSTACEOLOGY). The second class includes those which, after leaving the egg, appear under the form of the perfect insect, but have no wings; in which state it eats and grows, till, having passed the chrysalis state, it issues thence with wings, and is in a condition capable of propagating its kind. This class comprehends the orders of insects *Orthoptera, Dermaptera, Dictuoptera, Hemiptera,* and *Neuroptera,* of this work. In the third class, we find those insects which appear when hatched from the egg, under the form of a caterpillar (*Larva,*) which when full grown, changes into a chrysalis, where it remains until the parts are fit to be developed. The insects included in this class are the orders, 1. *Coleoptera,* and 2. *Aptera,* (Lamarck); *Suctoria,* (Latreille); whose larvæ divest themselves of their skin before transformation. The fourth class comprehends those who having attained the pupa (or chrysalis) state, do not divest themselves of their skin. The insects alluded to are the orders *Diptera* and *Hymenoptera* of modern entomologists.

Wolf. In the same year Wolf's *Dissertatio de Insectis, &c.* appeared at Leipsic. The author was professor of medicine at Jena.

Redi. In 1671, Redi published his *Experimenta circa generationem Insectorum,* in which he combats the long-maintained doctrine of equivocal generation with success; proving by experiments and close reasoning, the fallacy of such opinions. At the end of this book he has given figures of the lice of birds.

Perrault. In 1671, Claude Perrault, one of the most learned exotic entomologists of his age, author of several very ingenious papers in the *Memoirs of the French Academy,* published a folio work at Paris, entitled, *Memoires pour servir à l'Histoire naturelle des Animaux.*

Ferrard. In 1672, Ferrard published a work at Naples, of which we have no account, nor have we met with it.

Franzelio. In 1673, Franzelio submitted his *Insecta Noviaolii cum nive delapsa* to the world.

Mollerus. In the same year, at Frankfort, was published by Mollerus, *Meditatio de Insectis quibusdam Hungaricis prodigiosis anno proxime præterito, ex aere una cum nive in agros delapsis,* ornamented with wooden cuts.

In 1675, a tract on the natural history of the *Ephemera horaria*, by Swammerdam, appeared, entitled, *Ephemeri Vita of afbeeldingh van 's menschen leven, vertoont in de Historie van het uligent ende een-daghlevent Haft of Oever-aas.*

lerio.

And in the same year, an elementary tract by George Belerio, printed at Upsal, περὶ τῶν ἐντόμων.

ochart.

About the same time, also, by Samuel Bochart, a work entitled, *Hierozoicon, sive bipartitum opus de animalibus Sanctæ Scripturæ.*

In 1676, some additions to Claude Perrault's work were published.

räffinn.

In 1679, Madame Maria Sybilla Merian, *vel* Gräffinn, produced the first part of her work, "*Der Raupen wunderbare verwandelung und sonderbaire blumen-nahrung,*" which relates principally to European lepidopterous insects. The authoress was a native of Frankfort on the Maine, wife of John Andrew Gräffinn. In early life, she imbibed a taste for the study of insects, from being occupied at times in painting these objects as ornaments to her flower-pieces. The task of painting insects she performed with tolerable accuracy; yet there is "a peculiar exuberance of style incompatible with any faithful resemblance of nature." Many of her original drawings are preserved in the British Museum as specimens of her style.

agneri.

In 1680 was published, Johannis Jacobi Wagneri, *Historia Naturalis Helvetiæ curiosa.* Figuræ.

rew.

In 1681, Grew published his *Museum Regalis Societatis;* being a catalogue and description of the natural and artificial rarities belonging to the Royal Society of London, preserved in Gresham college. London. Folio.

In the same year, an English translation of Swammerdam's *Ephemeri Vita* was produced in London, and a French translation in Paris.

In 1682, a book entitled *Johannes Godartius of Insects, done into English, and methodised, with the addition of notes; the figures etched in copper by Mr P. Fib,* was published at York. It is supposed to have been translated by Lister; the initials M. L. are at the close of the address "to the reader." The impression, as we learn from the preface, consisted of one hundred and fifty copies, which were intended merely for the curious; and the notes are copious.

ister.

oppis.

In 1682, Hoppis published a dissertation on the *Gryllus migratorius.*

erian.

In 1683, the second part of Merian's *Der Raupen,* &c. appeared.

In 1685, the first Latin edition of Swammerdam's work was printed in Lyons, under the title, *Historia Generalis Insectorum, Latinam fecit* H. C. Hennius.

In this year also, Lister's Latin edition of Goedart, entitled, *J. Goedartius de Insectis in methodum redactus, cum notularum additione, opere,* M. Lister, in octavo, appeared in the Latin language. The author distributes the materials into a new form of arrangement, the merits of which are too obvious not to be considered as an improvement on the original production. He divides them into ten sections, as follow.

1. Those with erect wings, and angulated pupæ. *Butterflies.*
2. Those with their wings placed horizontally, and which proceed from caterpillars, called *geometræ* by Goedart, from their gait. *Moths.*
3. Those with deflexed wings. *Moths.*
4. *Libellulæ,* or dragon flies.
5. *Bees.*
6. *Beetles.*
7. *Grashoppers.*
8. *Dipterous,* or two-winged flies.
9. *Millepedes.* (Now *Crustacea.*)
10. *Spiders.* (Now *Arachnides.*) See the article CRUSTACEOLOGY.

Although we readily allow Lister the credit due for this arrangement, yet we cannot avoid expressing our regret for his remarks on the original author, to whom he allows neither credit as a naturalist nor as a writer. He highly praises his skill as a painter; but says, "Goedart, after forty years attention, seems to have made but little advancement in his skill in the nature of insects; he rather seems to have diverted himself, than to have given himself any trouble to understand them; and yet after all, you will find him everywhere just and correct, but in many places short and hardly intelligible." These opinions are delivered in a style of affected superiority over his author, highly unbecoming and not strictly true; and he gained no reputation on the continent for these illiberal remarks, which were much condemned.

Also, by the same author, *Appendix ad historiam animalium Angliæ.* London. Octavo.

Leeuwenhoek.

In 1687, Leeuwenhoek published his *Anatomia seu interiora rerum, cum animatarum tum inanimatarum, ope et beneficio exquisitissimorum microscoporum detecta.*

Geyereus.

In the same year, Geyereus wrote a treatise on the medicinal properties of Spanish flies, (*cantharides,*) under the title, *Tractatus physico-medicus de cantharidibus.*

Griendel.

Also by J. F. Griendel, at Neuremberg, in quarto, *Micrographia Nova,* in which some notice is taken of insects.

In 1688 was published an Italian edition of Redi's *Experimenta circa Generationem Insectorum,* entitled, *Esperienze intorno alla Generazione degl'Insetti.*

Blankaart.

In this year also, Stephen Blankaart of Amsterdam, published a work, *Schon Berg der Rupsen, Wormer, Maden en vliegende Dierkens daar uit voort-kommende.* The author was a physician, who devoted much time to collecting insects. The plates are admirably executed; but the work in other respects bears but an indifferent character. Frisch and Lyonet consider it but a superficial production. It treats of the larvæ of various insects, and a few perfect insects are also noticed. Another edition was published at Leipsic in 1690.

Cyprien.

John Cyprien also published at Frankfort, *Historia Animalium,* in the same year, in which insects are noticed.

Muralto. Mentzelius.

About this period, two papers on insects appeared, one by John de Muralto, the other by C. Mentzelius.

Bilberg.

In 1690, Bilberg published at Upsal a dissertation entitled, *Locustæ.*

König.

And in the same year, König's *Regnum Animale.*

In this year also, Stephanus Blancard published in octavo, at Leipsic, *Schon-burg der Rupsen, Wormen, Maden.*

Jungius.

In 1691, *Historia Vermium,* by Jungius, was printed at Hamburgh.

Sedileau.

In 1692, in the Memoirs of the French Academy, we find a curious paper, by Sedileau, entitled, *Observations* *lustigung*, by Rösel of Nuremberg, a man of genius, by profession a miniature painter. The work is in quarto. **Kleemannir. Kleemanahus.** Two other volumes appeared in 1749 and 1755. To these a fourth volume was added by a relation (Kleemannir) after his death in 1761; and, since that period, Kleemanahus published three other parts.

Menander. In 1747, a tract, explaining the advantages arising from the study of insects, entitled, *Dissertatio de Usu Cognitionis Insectorum*, was published by C. F. Menander.

Gould. In the same year, William Gould published in London *An Account of English Ants.*

Bazin. Also in Paris by Bazin, *Abrégé de l'Histoire des Insectes, pour servir de suite à l'Histoire Naturelle des Abeilles.*

Gadd. In this year also was published in quarto, Adrian Gadd *Observationes Physico-Œconomicæ, in septentrionali prætura territorii superioris Satagundiæ collectæ. Dissertatio Præside C. F. Menander*, Aboæ; an interesting tract, explaining the advantages arising from the study of natural history.

Lyonnet. In this year, *Theologie des Insectes* de Lesser, *avec des remarques* de Lyonnet, à la Haye, in two volumes octavo, appeared, being a translation, with comments by Lyonnet, of Lesser's *Insecto-Theologia*, published in 1738.

Augustin. Also Buzin Gilles Augustin *Abrégé de l'Histoire des Insectes pour servir de suite à l'Histoire Naturelle dès Abeilles.* Paris, in two volumes duodecimo.

Dutfield. In 1748, was published in London, by J. Dutfield, six numbers of a natural history of English moths and butterflies.

Hoppe. And, in this year, T. C. Hoppe published two small entomological tracts, as *Antwort-Schreiben auf Hern Schreibers zweifel;* and *Eichen-Weiden-und Dorrosen.* The first at Gera; the second at Leipsic.

In 1749, Linné published *Ejusdem Skänska Resa.*

And at Norembergh, J. M. Seligmann *Aves, adjectis ex* G. Edwardi *Iconibus.* Folio.

Wilks. In the same year, or perhaps earlier, the splendid work of Benjamin Wilks, under the title of *The English Moths and Butterflies, together with the Plants on which they feed, and are usually found.* The plates, which appeared first, bear no date. In the third volume of Rösel's work, *Insecten Belustigung*, we find comments on this work, not to the credit of English entomologists in general, when the science ought, from the labours of former writers, to have stood on very high ground in this country, and the public judgment to have been so far matured as to discover imposition. Rösel, in the plainest terms, accuses our author of piracy; and, when we reflect on the celebrity this work has heretofore enjoyed as an original production, it certainly attaches some little reproach to our naturalists, that facts, so publicly asserted on the continent, should have remained unknown to us. As the remarks are curious and interesting, we shall copy this part translated by a friend. "In the supplement, or third part of my amusements of insects, I have mentioned a certain work which Mr Wilks in London continues monthly, and promised that I should take some opportunity of giving a more circumstantial account. Since then the plates amount to ninety, all of which I have examined with great attention. They are as yet destitute of any description, which is, however, promised at some future period. In the notice to these plates, he professes to have drawn them from life; but, by those acquainted with other works, it will readily be discovered that several are taken from Albin's work, from Merian's book, and many from my own. How far he has succeeded, I leave to the judgment of others. An ape mimics every thing, but does not always succeed. I may appear to many too severe; but let them consider that he counterfeits the works of others, and gives them for his own. I venture to assert, that in the future description of his work, he will be careful not to mention the authors whose works he has so unjustly robbed; for he already strives to conceal on his plates what he has copied from others, by reversing the figures, or by giving them a different position." Vol. iii. p. 192. 1749. The substance of these remarks we are sorry to be under the necessity of allowing to be true; for the eye of the artist will perceive, on comparing the two publications, that Wilks has taken an unlimited range through the first volume of Rösel. We have repeated the remarks of Rösel at length, because we wish to impress on the public mind the value and importance of any general work, in preference to productions of this nature. Wilks was also publisher of *Twelve new designs of Butterflies*, in which the insects are disposed in stars, festoons, circles, or other whimsical groups, forming what are usually denominated "butterfly pictures." The nature of the first work above mentioned, is rather incorrectly stated in the title-page; for the plants on which the insects are grouped, are not those which furnish their natural food; they consist of gaudy flowers, auriculas, roses, monstrous varieties of cultured plants, fruits, &c. the introduction of which, in preference to their natural food, has incurred considerable censure.

Hill. In 1752, Dr Hill, in his *History of Animals*, published in London in the year 1752, divides insects into three classes: the first *Apteria*, includes all insects without wings; the second *Pteraria*, is devoted to the winged insects; the third *Gymnanthridia*, comprehends those with soft and naked bodies.

De Geer. De Geer also in this year, published the first volume of his invaluable work, *Memoires pour servir à l'Histoire des Insectes*, at Stockholm, which was received with every demonstration of praise to which its merits are entitled. From the testimony of the author's merit afforded by this volume, the continuation was expected with impatience; but nine years elapsed before the second volume appeared, and it was altogether twenty-six years from its commencement to its termination. It was completed in 1778, in which year the labours of its author closed with his life. He was author of several papers in various Transactions, which we shall notice in their proper place.

In this year also, Linné published two dissertations at Upsal, *Miracula Insectorum*, and *Noxa Insectorum.* The latter of these is very valuable, from the object in the contemplation of the author; and the first is not destitute of merit.

Scopoli. Scopoli, in the year 1753, published his *Entomologia Carniolica*, in which he distributes all the insects of which he treats, into orders, genera, species, and varieties, nearly after the manner of Linné. As a systematic work, this publication is of little importance; in other respects it is valuable.

In this year also, *Novæ Insectorum Species, Diss. Præsid.* Johanne Lecher. Resp. Isaacus Uddman. Aboæ, quarto.

Kalm. In the year 1754, Kalm, a learned botanist, published a paper on a species of *Cicada*, in the Swedish language; but we are unacquainted with its title.

Brown. In 1756, in folio, Brown's *Civil and Natural History of Jamaica.*

In 1757, *F. Hasselquists Iter Palæstinum, eller Resa* *till Heliga Landet aren* 1749—1752, *Utgifver af* Car. Linné, appeared at Stockholm.

In 1758, in quarto, an interesting work in its day, entitled, *Ejusdem Dissertatio. Centuria Insectorum rariorum, &c.* Upsaliæ.

Fleoyd.

In this year, an English translation of one of the works of Swammerdam was published in London by Thomas Fleoyd.

Schreberi.

And in 1759, J. C. D. Schreberi *Novæ Species Insectorum*, appeared at Halle.

In 1759, Caroli Linnæi *Animalium Specierum, &c. in formam enchiridii, Lugd. Bat.* Octavo.

In 1760, Caroli a Linné *Amœnitates Academicæ*, tom. v. Holmiæ, octavo.

In 1761, Linné published his *Fundamenta Entomologiæ*, being an introduction to the study of the science.

Poda.

In this year likewise, an interesting little work, entitled, *Insecta Musei Græcensis*, was given to the world by Nicolaus Poda, giving an account of the insects of Greece, arranged after the Linnean manner.

Sulzer.

J. H. Sulzer, in the same year, produced an introductory work to the study of insects, in quarto, illustrated by several plates, under the title, *Die Kennzeichen der Insekten nach Anleitung der Ritters*, Karl Linnæus, *durch 24 kupfertafeln erläutert, und mit derselben natürlichen geschichte begleitet.* Printed at Zurich.

And a new edition of Linné's *Fauna Suecica editio altera auctior*, Stockholmiæ, considerably enlarged and improved, appeared.

In the same year with the above, an octavo, *Det Trondjemske og Norske Videnskabers Selskabs Skivter.*

Thrane.

Also *Brunniche* Martinus Thrane. *Prodromus Insectologiæ Siællandicæ.* Hafniæ, octavo.

In 1762, *Histoire abrégé des Insectes aux Environs de Paris*, octavo.

Sepp.

In the same year, Sepp began his work, *Beschouwing per wondern gods in de minstgeachte schepzelen of nederlandsche Insecten*, which is entirely dedicated to the more rare butterflies and moths of Holland. The text is in the Dutch language; and the plates, which are very numerous, are admired for their peculiar neatness, being engraven in the dot or stipple stile with considerable delicacy and elegance.

In this year, a most valuable systematic work by Geoffroy, was published in Paris, and demands the attention of the modern entomologist. It is entitled, *Histoire abrégée des Insectes*, and divides insects into six classes: 1. *Coleopteres;* 2. *Hemipteres;* 3. *Tetrapteres à ailes nues;* 4. *Tetrapteres à ailes farineuses;* 5. *Dipteres;* and 6. *Apteres.* The first is the same with the Linnean order *Coleoptera;* the second is regulated by the form of the proboscis; the third agrees with the *Lepidoptera;* the fourth comprehends the *Neuroptera* and *Hymenoptera;* the fifth and sixth are the same with the Linnean orders *Diptera* and *Aptera.* The characters of these orders are taken from the number of joints in the feet; and the generic characters are taken from various parts of the body. Many of the genera are perfectly natural, and are still in use.

runniche.

Brünniche, in this or the following year, published two entomological tracts, *Prodromus Insectologiæ Siællandicæ*, and *Entomologia sistens Insectorum tabulas systematicas cum introductione et iconibus.* The latter is an elementary work in the Latin and Dutch languages.

ronovius.

In 1763, L. T. Gronovius published in folio, *Gronovii Zoophylacii.* Three fasciculi only appeared.

[illegible]

Also Johannis Antonii Scopoli *Entomologia Carniolica, &c.* Vindebonæ, in octavo.

Pontoppidan.

In this year, *Den Danske Atlas ued* Eric Pontoppidan, Kiobenhavn, appeared in quarto. Other parts appeared in the years 1764 and 1767, forming altogether three volumes in quarto.

Geoffroy.

In 1764, Dr M. Geoffroy published in two volumes quarto, *Histoire abrégée des Insectes, dans laquelle ces Animaux sont rangés suivant un ordre methodique.* Paris.

Linné in this year, again appeared before the public, and produced his excellent *Ejusdem Museum Lodovicæ Ulricæ Reginæ.* Holmiæ, in octavo.

Muller.

Also Otho Fr. Müller *Fauna Insectorum Fridrichsdalina sive methodica descriptio Insectorum agri Fridrichsdalensis, &c.* Hafniæ et Leipsiæ, octavo.

Also J. C. Schæffer's *Abhandlungen von Insecten.* 3 *Bande.* Regensburg, quarto.

Gronovius.

Also the second part of *Zoophylacium Gronovianum*, by Laudentius Theodorus Gronovius, containing descriptions of about six hundred insects, with synonyms after the Linnean system, accompanied by four illustrative plates, was printed at Leyden in folio.

Seba.

In 1765, Seba's *Thesaurus Naturæ* was published at Amsterdam, in which a vast number of the extra European insects are figured in a very coarse style.

Gleditsch.

In this year J. G. Gleditsch published at Halle, in 8vo. the first volume of *Vermischte Physicalisch Botanish Oeconomische Abhandlungen;* two other volumes appeared in the two succeeding years.

Also at Copenhagen and Hamburgh, Eric Pontoppidan's *Kurygefasste Nachrichten, die Naturhistoire in Dännaemark betreffend.*

Also *Det Kiöbenhavnske Selskabs Skrioter*, at Kiobenh.

Schæffer.

In 1766, Schæffer published at Regensburg *Elementa Entomologiæ*, containing 132 plates, illustrating the principles of his system, and an additional section with two plates, describing the manner of catching insects, and the manner of feeding them, with microscopes, &c. for examining them. He was author of another work on this subject, in the German language, entitled, *Zweifel und Schwürigkeiten, welches in der Insectenlehere annoch vorwalten*, published at Regensburg in 4to, but we are ignorant of the date.

In this year, also, a second edition of Frisch's work appeared.

Pallas.

In 1767, Pallas published at Berlin, in 4to, the first fasciculus of his *Spicilegia Zoologica quibus nova informis et obscuræ animalium species Iconibus, descriptionibus atque commentariis illustrantur*, a very valuable work. Several other numbers or fasciculi were published before the year 1780, when the last made its appearance.

And in the same year, the twelfth edition of the *Systema Naturæ* of Linné was produced. As this was the last work of that illustrious naturalist, we shall lay before our readers his entomological arrangement. He divided insects into seven orders, deducing his characters from their wings, as follow:

Order I. Coleoptera, (from κολεὸς, *a sheath*, and πτερὸν, *a wing*), including those insects having crustaceous shells or elytra, which shut together and form a longitudinal suture down the back of the insect. In many the whole body (abdomen) is covered by these elytra, in others partially. The coleopterous insects comprehend those commonly termed *beetles.*

Order II. Hemiptera, (from ἥμισυ, *half*, and πτερὸν, *a wing.*) These animals have their upper wings half crustaceous, and half membranaceous, or of a matter intermediate between leather and membrane. *Examples*, the bug, the locust, &c.

Order III. Lepidoptera, (from λεπὶς, *a scale*, and πτερὸν, *a wing.*) Insects having four wings imbricated with scales. *Examples,* butterflies and moths.

Order IV. Neuroptera, (from νεῦρον, *a nerve,* and πτερὸν, *a wing.*) Insects having four transparent naked wings, reticulated with veins or nerves. *Examples,* libellulæ, or dragon-flies, &c.

Order V. Hymenoptera, (from ὑμὴν, *a membrane,* and πτερὸν, *a wing.*) Insects with four naked and membranaceous wings. *Examples,* bee, wasp, &c.

Order VI. Diptera, (from δύω, *two,* and πτερὸν, *a wing.*) Insects with two wings, as gnats, flies, gadflies, &c.

Order VII. Aptera, (from ἀ, *without,* and πτερὸν, *a wing.*) Includes all insects without wings, as spiders,* crabs, lice, &c.

The great perspicuity of Linnæus's System of Entomology, arose from its author having made choice of the most obvious characters which insects afford for the leading distinctions of his orders. In the construction of his genera, he has taken his characters from the parts of the head alone, paying particular attention to the form, situation, and structure, of the antennæ or horns; these parts being conspicuous in most insects, and so infinitely varied in their appearance, as to constitute, with few exceptions, a permanent distinction. That there are other characters which, in the opinion of later entomologists, are better adapted to the purpose of classification, the reader must be aware; but these, although really preferable, are perhaps too minute to become always useful to the student; yet to the man of science, who is really willing to learn and study entomology as a science, there can be no doubt as to the superiority of the modern systems, although we are ready to allow that the characters from the mouth are not so well calculated to further the views of the superficial observer, as those proposed by Linné; the simplicity of his arrangement, the celebrity of his name, and the princely patronage under which he wrote, conspired, with other favourable circumstances, to render the science more universally cultivated, admired, and respected, about his time, than it appears to have been at any former period. Much credit is undoubtedly due to this great man for his entomological labours; but as we have stated before, when speaking of Aristotle, he is not alone entitled to our commendation for the arrangement he has proposed; we must acknowledge the merits of his predecessors, who wrote under less favourable circumstances, but nevertheless excelled in this department of science; men to whom Linné stands in a very high degree indebted, and without the aid of which it is impossible to imagine the system which now commands our respect. In the works of Aristotle and Pliny, in those of Aldrovandus, Swammerdam, Ray, Willoughby, Lister, and various others, (whose works we have noticed), we perceive, with some variations, the grand outline on which he has formed his system. It was from these valuable sources that he gained the materials, from which he selected, with profound judgment, and the greatest success, the valuable matter, carefully and industriously separating the dross. The characters of his orders and genera also are to be found in several earlier publications, as are descriptions of several of the species. But he has concentrated these scattered rays of science with so much skill and industry, that we must admit that to him alone the science is indebted for that firm foundation on which it now rests. His style throughout is concise and expressive, but in many instances it is so laconic, that it is impossible even to guess at the animals described.

Bomare.

In 1768, was published in Paris, Bomare *Dictionaire raisonné universel d'Histoire Naturelle,* 4to.

Schæffer.

In 1769, in three volumes 4to. *Ejusdem Icones Insectorum circa Ratisbonum Indigenorum, &c.* Regensburg, by Schæffer.

Scopoli.

And in the same year, at Leipsic, was published in octavo, J. A. Scopoli *Anni Historico Naturales.*

Berkenhout.

Also Dr John Berkenhout, M. D. published the first edition of his *Outlines of the Natural History of Great Britain.* That portion containing insects is very limited, treating of no more than six hundred species, which are arranged after the Linnæan system. Notwithstanding the small number of species enumerated, this little work has tended materially to advance the study of entomology in Great Britain. Since the publication of the above, three or four other editions have appeared.

Forster.

In 1770, J. R. Forster published, at Warrington, in octavo, *A Catalogue of British Insects,* a mere list of Latin names, amounting to about 1000 species, the greatest number hitherto enumerated. This was intended as a Prodromus to a general work on the insects of Britain, as we learn from the preface, in which the author offers duplicates in exchange for any not in his collection.

Drury.

In this year also, D. Drury published a very beautiful work in one volume, containing comprehensive descriptions in English and French, with an index of Linnean names, illustrated by coloured copperplates, entitled, *Illustrations of Natural History, wherein are exhibited Figures of exotic Insects, &c.* The plates form a miscellaneous assemblage of the more beautiful extra European insects, which the extensive collection of its author afforded. Three years after the publication of the first volume, a second appeared; and the third, which concludes the work as far as it proceeded, appeared in 1782. Besides those figured and described in the three volumes published, the extensive cabinet of Mr Drury contained many choice specimens, reserved as materials for a fourth volume, amongst which were a vast number of curious species, collected in the interior of Africa, and other parts of the world, rarely visited by Europeans, the introduction of which would have rendered this volume, (which was never published,) of much greater interest to entomologists in general, than either of the preceding. We may observe, that Mr Drury's cabinet was one of the most extensive ever made, and is said to have contained, in species and varieties, no less than 11,000 insects, (in his time the largest collection,) which he obtained by transmitting printed directions and instructions, in various languages, for gathering and preserving insects, offering sixpence an insect for all insects, "from the size of a honey-bee upwards." His museum of entomology was disposed of, in London, by public auction, and produced about six hundred pounds. One insect, viz. *Scarabæus Goliathus,* (*Golinthus magnus,*) was purchased by Mr Donovan, for twelve guineas and a half, who obtained also all the British insects, (which were very numerous,) collected by Mr Drury, and now enrich his splendid museum.

Harrer.

And in this year also, G. A. Harrer's *Besthreiburg derjenigen Insecten welche Herr* D. J. Christoph. Schæffer *in* cclxxx *ausgemahlten kupfertafeln herausgegeben hat.* Regensburg, octavo.

Fors

In 1771, John Reinhold Forster published *Nova*

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* The crabs and spiders are now considered as constituting two distinct classes. See our article Crustaceology.

species Insectorum centuria, 1; the avowed purpose of which, as the reader is informed in the preface, was to give descriptions of one hundred insects, not mentioned in the latest work of the illustrious Linné. The insects included are partly indigenous; some are from China, and others from South America. The greater number of these are coleopterous insects, and are arranged after the manner of Linné, except the genera *anthribus* and *cistela*, which are taken from Geoffroy. We may observe many of the insects seem to have been unknown to Linné, and some few were previously made known to the world, by the works of Schæffer and Drury. This the author was aware of; but as they had escaped the observation of Linné, whose work he was solicitous to improve, it was considered right to introduce them. He was one of those eminent naturalists who accompanied the celebrated Captain Cook in his voyage round the world, and his labours as an entomologist in these times entitled him to respect.

The *Mantissa Plantarum altera generum editionis* vi. *et Specierum editionis* ii. Holmiæ, of Linné, in which several insects, not noticed in other parts of his works, are described, octavo, appeared in this year.

Curtis. In 1772, Curtis published in London a translation of the *Fundamenta Entomologiæ* of Linné, which considerably advanced the study in this country.

Lettsome. And in the same year, Dr John Coakley Lettsome, published in octavo, *The Naturalists and Travellers Companion,* giving directions how to collect and preserve all sorts of natural productions. It has since undergone several editions, and may be considered as a very useful book to students of entomology.

Brunnichii. Also M. Th. Brunnichii *Zoölogiæ Fundamenta prelectionibus academicis accommodata,* Hafniæ et Lipsiæ, octavo.

Kahn. In 1773, Kahn published a tract relative to the mode of preserving and catching insects, entitled *Kurze anleitung Insecten zu sammlen.*

Yeats. Thomas Pattinson Yeats published *Institutions of Entomology*; an useful work, being a translation of the Linnean orders and genera, collated with three other systems, namely, those of Geoffroy, Scopoli, and Schæffer, together with many ingenious observations, by its translator. It is particularly defective, however, in the comparison drawn between the systems of Linné and Scopoli, from an event which could not be anticipated. When Scopoli published his *Entomologia Carniolica,* he coincided very nearly with Linné, in his arrangement; but in a work of his, (soon to be noticed,) he abandoned that method, and adopted another. For an account of the system alluded to, see the year 1777.

Pallas. In this year, the account of a tour made by the celebrated Russian naturalist Pallas, appeared, entitled, *P. S. Pallas Reise durch Verschiedene Provinzen des Russichen Reichs. St Petersburgh,* which has been rendered into Latin and English.

Hill. In this year, also, Dr John Hill published a *Decade of curious Insects, some of them not described before, shown in their natural size, and as they appeared before the Lucernal Microscope, in which the Apparatus was artificially illuminated; with their History,* &c.: illustrated with ten quarto plates, in which the figures are sometimes immensely magnified, and far from correct. The scientific accounts are given in English, accompanied with various interesting observations as to their natural history and economy.

Wilks. In the *Transactions of the Entomological Society of London,* vol. i. part 1. the work of Benjamin Wilks is stated to have been published in this year, but is noticed by us as having been published in the year 1749, or earlier: but, from the comments made on that work by Rösel, it must have been published, as we have stated, in or before 1749.

L'Admiral. In 1774 was published at Amsterdam, in folio, by Jacob L'Admiral, *Veranderingen van Veele Insecten.*

Also, at Halle, in 8vo. *Der Naturforscher,* but the author's name not known to us.

Tagebuch. And, in this year, Iwan Lepechius Tagebuch *der Reise durch verschiedene Provinzen der Russischen Reichs*; Altenburg. One volume appeared first, and two others before 1783.

Faeslins. In 1775, an interesting little work, describing the insects of Switzerland, under the title *Verzeichniss der ihm Bekanten Schweitzerischen Insecten,* was printed at Zurich, in quarto, by Joh. Gaspar Faeslins.

Fabricius. In this year, J. C. Fabricius, a pupil of Linné, published a new system of entomology, under the title *Systema Entomologiæ,* in which the principles of a new mode of classification is for the first time developed. He has taken the essential characters of the classes (*orders,* Linné would have termed them) from the parts of the mouth (*Instrumenta cibaria*), which has given this the title of *Cibarian System.* He, in this work, divides insects into eight classes, viz. Eleutherata, Ulonata, Synistata, Agonata, Unogata, Glossata, Rhyngota, and Antliata. In this part of his system he has been followed by very few; but his mode of distinguishing the genera is still retained, and opens the way to the knowledge of natural genera, which, by his method, are generally to be distinguished without examination of any other parts. As he has since that time written several other works, and added considerably to this system, we shall defer noticing it further for the present. We may, however, observe, that he gained such reputation from this work, that he was induced to prosecute his entomological studies with increased ardour, and during his lifetime always held the highest rank as an entomologist.

Forskal. Also, *Descriptiones Animalium, Avium, Amphibiorum, Piscium, Insectorum, Vermium; quæ in Itinere Orientali observavit,* Petrus Forskal, Prof. Havn. *Post mortem Auctoris, edidit* Carsten Niebuhr; Havniæ, quarto.

Harris. Moses Harris also published a little pamphlet, entitled, *The English Lepidoptera, or Aurelian's Pocket Companion,* &c. London; an alphabetical catalogue of the larger lepidoptera collected by its author in England. This little tract, although apparently insignificant, has materially contributed to the practical study of entomology. The Linnean names, as far as they were known to him, with the time and place of the appearance of the insects, in both states, are concisely given in columns. A frontispiece is added, explaining the terms used in the description of animals of this order.

Brown. In 1776, Peter Brown figured a number of insects in his *New Illustrations of Zoology.*

Sulzer. In this year, Sulzer published, in quarto, *Abgekürzte Geschichte der Insecten,* Winterthur.

Fabricius. The *Genera Insectorum* of Fabricius appeared in this year.

Sulzer. In this year, also, J. H. Sulzer's *Abgekürtze Geschichte der Insecten,* 2 Theile, quarto.

Schrank. Also, *Beytrage zur Naturgeschichte von Franz,* von Paula Schrank, Leipzig, in octavo.

Müller. In this year, O. F. Müller *Zoologiæ Danicæ Prodromus,* &c. Hafniæ, appeared in octavo, and must ever be considered a most valuable and useful work.

Schröter. In this year was published at Halle, in octavo, the first part of a work, entitled, Joh. Schröter *Abhandlungen über verschiedene Gegenstande der Naturgeschichte*; a succeeding part appeared in 1777.

A valuable book in quarto, entitled, *Systematisches Verzeichniz der Schmetterlinge der Wienergegand*, &c. Wien, appeared in this year.

Scopoli. In 1777, Scopoli published the systematic work before alluded to, under the title, *Introductio ad Historiam Naturalem*. In this work (which does not relate exclusively to the science of entomology), he divides insects into five tribes, under the singular appellations of *Swammerdami-lucifuga*, *Geoffroy-gymnoptera*, *Röeselii-lepidoptera*, *Reaumurii-proboscidea*, and *Frischii-coleoptera*. In this manner he identifies each tribe with the name of that author who has, in his opinion, been most successful in the explanation of that to which his name is attached. The order *Lucifuga* includes two genera; 1. *Crustacea*, 2. *Pedicularia*. *Gymnoptera* comprehends his *Halterata*, *Aculeata*, and *Caudata*. *Lepidoptera*, the genera *Sphinx*, *Phalæna*, and *Papilio*. *Proboscidea*, he divides into *terrestrial* and *aquatic*. And the *Coleoptera* he divides likewise into those inhabiting water, and those the land.

Göeze. In this fertile year, J. A. E. Göeze began to publish an extensive systematic work called *Entomologische beyträge zu des Ritters Linné zwölften Ausgabe des Natur Systems*, &c. which was continued progressively in parts till 1783, in octavo.

Esper. Esper also produced in Germany the first part of his valuable work on lepidopterous insects, entitled, *Die Schmetterling in Abbildung nach der Natur mit Beschreibungen*, accompanied by many plates, of which a second part was published in 1779. Between that time and 1786, two other parts appeared likewise, and which, altogether, form a very extensive publication.

Pallas. In 1778, at Berlin, was published in quarto, by Peter Simon Pallas, *Naturgeschichte Merkwürdigen Thiere, in welcher Vornehmlich neue und unbekannte Thierarten durch kupferstriche, Beschreibungen und Erklärungen erläutert werden.*

Czempinsky. And Paul Czempinsky published, in octavo, *Totius Regni Animalis Genera*.

Bergstraesser. Also, in quarto, *Nomenclatur und Beschreibung der Insecten in der Graffschaft Hanau-Münzenberg, von* Joh. And. Ben. Bergstraesser.

Fuesly. Also, *Magazin für die Liebhaber der Entomologie Herausgegeben, von* Jos. Casp. Fuesly, Zurich und Winterthur.

Fischer. And, in this year, at Leipsic, in octavo, was published, *Versuch einer Naturgeschichte vöm Livland, entworfen von* J. L. Fischer.

Harris. Moses Harris also published his *Aurelian, or Natural History of English Insects, namely, Moths and Butterflies*, London, in quarto.

Fabricius. Lastly, J. C. Fabricii *Philosophia Entomologica*, &c. a work to be studied by every scientific entomologist.

Cramer. In 1779, Pieter Cramer published, *De vit Landsche kapellen, Voorkomende in de drie Waereld deelen Asia, Africa, en America*, or extra European insects, which, with the continuation published in the year 1782, consists of four volumes quarto, with many plates, confined entirely to lepidopterous insects.

And, in the same year, another very expensive work, in the French language, named *Papillons d'Europe, peints d'après Nature*, which, as its title shews, is devoted entirely to the lepidopterous insects.

Leske. In 1779, was published, in octavo, *Anfangs-gründe der Naturgeschichte, von* Nath. Gotft. Leske. Leipzig.

In 1780, in Berlin, was published, in octavo, *Schriften der Berlinischen Gesellschaft Naturforschenden Freunde.*

Otho Fabricius. Also, Otho Fabricii *Fauna Grænlandica*, &c. Hafniæ et Lipsiæ; a valuable little work, in one volume octavo.

Barbut. In 1781, was published, in London, by James Barbut, an elementary work, *The Genera Insectorum of Linnæus, exemplified by various Specimens of English Insects.* As an illustration of the Linnean system, this work may be not uninteresting to the English reader, but its views are too limited to admit of even mere general utility. Its author does not seem to have been aware of the vast improvements the science had undergone on the Continent, in the interval between the publication of the *Genera Insectorum of Linné*, and the time in which he wrote; and has therefore drawn no comparisons between them, which, without innovation, must have placed the science in a more lucid point of view. It is to the silence of English writers in this respect, arising either from want of information, from sentiments of illiberality, from jealousy, or negligence, that we must ascribe the very low state of entomological knowledge in Britain, even to the present period.

Schrank. In the same year, Franciscus Paula Schrank distinguished himself by his enumeration of the insects of Austria, called *Enumeratio Insectorum Austriæ Indigenorum*, which has since been rendered into German by Fuesly.

Laicharting. Johann Nepomuk von Laicharting, in this year, published, at Zurich, the first part of his catalogue of the insects of the Tyrol, *Verzeichniss und Beschreibung der Tyroler Insecten*; a second part appeared in 1784. He adopts a system distinct from that of Linné. Insects by him are divided into ten classes or orders, characterised from various parts of the body. These orders are named, *Scarabæöides*, *Gryllöides*, *Cimicöides*, *Papilionöides*, *Libelluloïdes*, *Vespöides*, *Muscöides*, *Cancröides*, *Aranöides*, and *Oniscöides*.

Pallas. In this year, the *Icones Insectorum præsertim Rossiæ, Siberiæque, peculiarium, quæ Collegit et Descriptionibus illustravit*, Petrus Simon Pallas, M. D. Erlangiæ, appeared in one volume quarto.

Herbst. And Herbst published *Archiv der Insectengeschichte, Herdusgegeben von* Jos. Caspar Fuesly; Zurich und Winterthur. In quarto.

Jacquin. In this year, Nicolas Joseph Jacquin published in quarto, *Miscellanea Austriaca, ad Botannicam, Chemiam et Historiam Naturalem.*

Also the *Genera Insectorum of Linnæus*, &c, by James Barbut; London, quarto, another edition.

Thunbe And Thunberg published at Upsal, *Ejusdem Museum Naturalium Academiæ Upsalensis, &c.* Pars 1.; to which twenty other parts, and an appendix, were added before the year 1800.

Knoch. Also, *Beitrage zur Insektengeschichte von August*, &c. Wilhelm Knoch; Lipzig, octavo.

And J. C. Fabricii *Species Insectorum*, appeared in the same year.

In 1782, Moses Harris published his *Exposition of English Insects*, &c. illustrated by fifty-one copperplates, in quarto, in which he has given figures of about 500 species. The text is in French and English, and the specific names are given in Latin, but many such as can never be adopted; such as, for example, (*Apis*) *Audeo*, &c.

Pontop dan. And in quarto, Eric Pontoppodan *Det forste Forsog paa Norges Naturlige Historia, Kioberhavn.*

Morand In the Transactions of the Paris Academy for this year, we find a paper by Morand, entitled, *Memoire sur les Vers de Truffes, et sur les Mouches qui en proviennent.*

Semler.

J. S. Semler also published, in the German language, under the title *Versuch eines Diarium über die Œconomie Mancher Insecten im Winter.*

Fuesly.

Another interesting work appeared this year, *Nues Magazin für die Liebhaber der Entomologie, Herausgegeben, von* Joh. Caspar Fuësly, Winderthur, in octavo.

A Part of the *Encyclopédie Methodique,* comprehending *Histoire Naturelle des Animaux,* was published in Paris in this year.

Retzius.

In 1783, Retzius produced his *Genera et Species Insectorum,* in which the method of De Geer is simplified, and the terminology of Linné is partly adapted to that performance. He divides insects into fourteen classes, under the titles, *Lepidoptera, Alinguia, Neuroptera, Hymenoptera, Siphonata, Dermaptera, Hemiptera, Coleoptera, Halterata, Proboscidea, Suctoria, Ancenata, Atrichelia,* and *Crustacea.*

In this year, a tract on the *Aphides* (*plant-lice,* or *pucerons*), appeared, entitled, *Nachlese zur Bonnetischen Insectologie.*

Curtis.

And W. Curtis published an interesting little pamphlet, *A short History of the Brown-tail Moth,* the larvæ of which appeared in such immense swarms in the fields surrounding London, during the summer of 1782, and despoiled so many trees of their foliage, as to create apprehensions of the total destruction to the whole vegetable tribe. The object of this tract was to show, that grass, not being the food of these voracious animals, would escape their attack. This is an additional proof, that some benefit at least may result from an acquaintance with the natural history of insects; for the author, by this publication, was enabled to dispel the uneasiness occasioned by these supposed "ministers of famine," and which prevailed to such an alarming extent throughout the whole population of that vast metropolis, that prayers were ordered to be read in all the churches to avert the supposed impending calamity.

And the following work, which we have never seen, but understand to be a valuable publication, *Abhandlungen der Hallischen Natur-forschenden Gesellschaft,* Dessan und Leipzig, in octavo.

Retzia.

Also, the interesting work by Baron De Geer, *Genera et Species Insectorum, currante,* A. J. Retzio, Lipsiæ, octavo.

Bergstraesser.

In 1784, an elementary work, in octavo, entitled, *Entomologia Scolarum in usu Concinnata,* was published by J. A. B. Bergstraesser.

Thunberg.

Thunberg, in this year, published his *Dissertatio Sistens Insecta Svecica.*

Harrer.

And, in the same year, Harrer wrote on the insects of Germany, under the title, G. A. Harrer's *Beschreibung Derjeniger Insecten Welche Her* D. I. C. Schæffer, &c. at Regensburg, in octavo.

Herbst.

Herbst also produced his work, entitled, *Kurze Einleitung zur Kenntniss der Insekten,* Berlin, octavo.

Laicharting.

Laicharting published at Zurich, *Johan Nepomuk, von* Laicharting *Verzeichniss der Tyroler Insecten,* 2 tom. octavo.

In 1785, the following works appeared:

Fourcroy.

Entomologia Parisiensis, sive Catalogus Insectorum quæ in agro Parisiensi reperiuntur, Secundum Methodum Geoffræanam, &c. edente A. F. De Fourcroy, duodecimo, in two volumes.

Martyn.

Matthew Martyn's *Aurelian's Vade Mecum,* &c. was published in Exeter. The insects are whimsically arranged, according to the Linnean classes and orders of plants on which they feed.

Bonsdorff.

Historia Naturalis Curculionum Sueciæ; auctore Gabriel Bonsdorff, &c. Upsaliæ; in quarto.

Natursystem aller Bekanten in und Auslandischen Insecten, &c. von Carl. Gustaf. Jablonsky, Berlin, *Fortgesetzt von* J. F. W. Herbst.

Reise.

Nath. Gotfr. Leske Reise *Durch Sachsen in Rücksicht der Naturgeschichte und Œconomie,* Leipzig; in quarto.

Schrank. Moll.

Natural-Historische Briefe über Œstreich, &c. von Franz, *von* Paula Schrank, und Karl Erenbert Ritter, von Moll; Salzburgh.

Walfen.

In 1786, Xavier Walfen published an account of the insects inhabiting the Cape of Good Hope.

Beitrage zur Geschichte der Schmetterlinge, Ausburg.

Schwiedleins Einleitung in die Insectenlehre, Leipzig, in octavo.

Scopoli *Deliciæ Floræ et Faunæ, &c. Ticini,* in folio.

In 1787, were published the following works:

Cyrillus.

By Dominicus Cyrillus, a folio work on the insects of Naples, entitled *Entomologiæ Neopolitanæ.*

A curious little tract, on the gad-fly, was published in Leipsic, by J. S. Fischer, entitled *Observationes de Oestro ovino atque bovino factæ.*

Fabricius printed his *Mantissa Insectorum, &c.* Hafniæ, in two octavo volumes.

Petagna.

Vincentii Petagnæ *Specimen Insectorum Ulterioris Calabriæ,* Francofurti et Moguntiæ.

Meidinger.

Meidinger *Nomenclator,* (*Versuch einer Deutschen Systematischen Nomenclatur aller in der letzen Ausgabe des Linneischen Natursystems befindlichen Geschlechter der Thiere,* Wien.) octavo.

Kongb. Svenska Vetenskaps Academiens Handlingar, in octavo. This work is often quoted thus, *Act. Holm.*

Adams.

John Adams published *Essays on the Microscope,* in quarto, at London.

Anderson.

In 1789, a series of letters on the important subject of the cochineal insect, (which had been discovered at Madras a few years before,) from James Anderson, addressed to Sir Joseph Banks, from Madras were publised. Two other letters on this important subject have been published since.

Swederus.

And in the same year Swederus published a monograph on that curious and interesting genus *Cerapterus,* in a memoir entitled *Beskrifuing poa elt nytt genus ibland insecterna, hörande til Colcoptera.*

Borkhausen.

The work of M. B. Borkhausen, treating of the lepidopterous insects of Europe, part 1. appeared at Francfort, under the title *Naturgeschichte der Europaischen Schmetterlinge nach Systematischer ordnung.*

Gmelin.

J. F. Gmelin published his edition of the Linnean *Systema Naturæ.* The entomological part is comprized in three parts, and was published in Leipsic. The editor is considerably indebted to the writings of Fabricius; and although he rejects his classification, yet he has copied the species, and incorporated them with the Linnean genera, which he has divided into families answering to the Fabrician genera, and has, by this means, very materially augmented and improved the original work of Linné; although we must allow that he has committed a vast number of the most inexcusable blunders, especially in his quotations and references to plates. He has also, in many instances, described the same animal twice, or three times, under different names. We are surprised that his errors are less numerous, as he can be esteemed in no other light than as an industrious closet compiler.

Goeze.

In this year, also, was published, in Leipsic, octavo, a work entitled *Nützliches Allerley aus der Natur und dem gemeinen Leben für allerley Leser von* Joh. Aug. E. Goeze.

Marsham. And Mr Marsham wrote the article entomology for Hall's Encyclopædia, which is illustrated by three plates. In this article he briefly explains the entomological system of Linné, and mentions the names of other authors of eminence; and likewise explains the mode of collecting and preserving insects.

Also *Beobachtungen und Entdeckungen aus der Naturkunde von der Gesellschaft Naturforschender Freunde zu* Berlin, in octavo.

Likewise J. T. Zs-chach, *Museum N. G. Leskeanum pars Entomologica*, octavo, Lipsiæ.

In 1789, a second edition of Berkenhout's outlines, under the title of *Synopsis of the Natural History of Great Britain, &c.* appeared.

Roemer. And Johannes Jacobus Roemer published his *Genera Insectorum Linnæi et Fabricii, Iconibus illustrata, &c.* Vitaduri Helvetorum, in quarto, with thirty-seven explanatory plates, nearly all of which had previously constituted the work of Sulzer.

Olivier. In this year, also, the first part of a most voluminous work, on entomology, was undertaken, at Paris, by the celebrated Olivier, entitled *Entomologie, ou Histoire Naturelle des Insectes, avec des charactères génériques et specifiques, &c.* par M. Olivier, M. D. a Paris, in quarto. From its title, we might infer, that the author intended to have treated on every class and order, and, in conformity with the first part, to have illustrated the whole with figures. He, however, has confined the work, which is very extensive, entirely to the order coleoptera, which was rendered as complete as possible; it is, however, as must be expected, a very defective, yet a valuable and useful work.

Paykull. Paykull published in this year, at Upsal, *Ejusdem Monographia Staphylinorum Sueciæ*, in octavo.

Villers. And C. de Villers published, at Lyons, a small work, under the title of *Linnæi Entomologia, &c. curante et augente Carolo de Villers*, Lugduni, in octavo, in which he professes to avail himself of the works of Scopoli, Geoffroy, De Geer, and Fabricius.

Jablonsky. In this year *Natursytem aller bekannten in und auslandischen Insecten, &c. von* Carl. Gustav. Jablonsky, *und fortgesetzt von* Johann. Friedrich. Wilhelm. Herbst, Berlin, appeared in octavo.

Leske. And at Leipsic, in octavo, *Anfangs-gründe der Naturgeschichte von*, Nath. Gotfr. Leske.

Mayer. In 1790, some remarks on the genus *Melolontha* occur in the *Journal für die Entomologie*, by Mayer, who, in the following year, published a work, in octavo, at Dresden, entitled *Sammlung Physikalischer aufsätze, besonders die Böhmische Naturgeschichte betreffend, von einer Gesellschaft Böhemischer Naturforscher; herausgegeben von*, Dr Johann. Mayer.

Preysler. In the same year, 1790, appeared Johann. Daniel Preysler *Verzeichniss Böhmischer Insecten*, Prag. in quarto, which is a catalogue of the insects of Bohemia.

Rossius. And *Fauna Etrusca, sistens Insecta, quæ in provinciis Florentina et Pisana præsertim collegit*, Petrus Rossius, &c. Liburni, in quarto.

Quesnel. Also, *Dissertatio Historico-Naturalis, ignotas Insectorum species Continens*, Conrad Quesnel, Lundæ, in quarto. Quesnel is author also of two tracts, but we are ignorant of their dates; they are entitled *Beskrifningar öfer 8 nya Suenska, Dagfjärillar*, on *Papilio*; the other on *noctua pruni, Beskrifning öfver en y Nattfjäril.*

Paykull. Paykull published, in the same year, his *Monographia Caraborum Sueciæ.*

Scriba. Two works, by Scriba, were also published in this fertile year, *Beytrage zu der Insectem Geschichte, Herausgegeben von* Ludwig Gottlieb Scriba, Frankfurt, in quarto, part the first; and *Journal für die Liebhaber der Entomologie, Herausgegeben von* L. G. Scriba, Frankfurt, in octavo.

Mainz. And *Insecten Kalender, von* Nic. Jos. Brahm. Mainz, in octavo.

Shaw. Lastly, a work which we scarcely consider as worthy of notice, it is entitled the *Naturalist's Miscellany*, or, as it is also termed, *Vivarum Naturæ*, by G. Shaw; the figures by P. Nodder. It contains a variety of daubed, (or, as they are termed, coloured) figures, of the more beautiful and larger exotic insects, as well as other animals, with descriptions extremely suitable to the general class of readers, (children,) for whose purpose, we conjecture, it was designed by its author, who, with greater advantages than any other naturalist in this country, has produced this publication, which, we are sorry to state, reflects the greatest disgrace on the class of readers who could give encouragement to so contemptible a performance. We notice it, as we perceive it quoted by children, who, (with such a work as the author *might* have given to the world,) would very probably be induced to bestow some attention to the study of natural history, so much neglected in this country.

In 1791, a year which produced several valuable entomological works, Meyer published a work which we have noticed under the year 1790, whilst speaking of another of his works.

Marsham. The first volume of the *Transactions of the Linnean Society of London* was published in London, containing a paper on *Phalæna Bombyx Lubricepeda* of Linné, and some other species allied to it, by T. Marsham, Esq.; some observations on the natural history of *Curculio Lapathi*, and *Silpha grisea* of Linné, by W. Curtis, Esq.; account of a singular conformation in the wings of some species of moths, by Esprit Giorna of Turin; and descriptions of two new species of *Phalæna*, by Louis Bosc of Paris: lastly, under the head of extracts from the minute book, we find mention of a new *Buprestis*, communicated by Mr Dryander.

Schneider. In the same year, *Neuestes Magazin für die Leibhaber der Entomologie, herausgegeben von* D. H. Schneider *5 hefte*. Stralsund, in octavo.

Ludwig. Also an interesting work on some of the Hymenoptera, entitled, *Naturgeschichte, Klassification, und Nomenclatur der Insecten von Bienen, Wesgen, und Ameisengeschlet.* Frankfurt am Main, quarto, by Christins Johannes Ludwig.

Donovan. In the year 1792, several valuable works were produced, and amongst others, the first part of a very considerable work, *the Natural History of British Insects*, by Edward Donovan, which has since been continued in monthly numbers until the present time. The design of this immense undertaking is to afford general and scientific descriptions of all the insects of Great Britain, accompanied with a coloured figure of each, as far as possible in their various states of transformation. The work at this time consists of eighteen volumes, and includes an extensive variety of the species, being the most extensive work hitherto undertaken as an elucidation of the Entomology of Britain. It is in octavo, and still continues to appear in monthly numbers.

Martyn. Thomas Martyn published in this year, in imperial quarto at London, *The English Entomologist, exhibiting all the coleopterous Insects found in England, including upwards of five hundred different Species, the*

Figures of which have never been given to the Public; the whole accurately drawn and painted after nature, arranged and named according to the Linnean system. The figures given in this work are useless, and its letterpress is but indifferent.

Fabricius. Fabricius in this year published his *Entomologia Systematica*: a supplement appeared in 1798, under which head we shall notice his system.

Paykull. Paykull also, whose name we have often noticed, produced his *Monographia Curculionum Sueciæ*; a species of writing which has tended more than any other to the promotion of natural history.

Panzer. In 1793, the *Ejusdem Beyträge zur Geschichte der Insecten*, Erlangæ of Panzer, appeared, who in the same year began his most interesting work in monthly numbers, entitled *Fauna Insectorum Germanica Initia, oder Deutchland Insecten, auctore* W. F. Panzer, which still continues to be published.

Smith. Dr Smith's *Tour on the Continent in* 1786 and 1787, appeared in this year. It contains some interesting remarks on the insects which occurred in his journey.

Brahm. And Nicolaus Joseph Brahm. *Verzuch einer Fauna Entomologica der Gegend um Mainz. Rheinisches Magazin zur Erweiterung der naturkunde, herausgegeben von* Moriz Balthazar Borkhauzen. Giessen, 8vo.

Abtheilung. Also an interesting work in 4to, entitled, *Nomenclator über die in den Röselschen Insecten belustigungen und Kleemanschen Beytragen zur Insectengeschichte abgebildeten und beschriebenen Insecten und Würmer mit moglichst vollslandiger Synonymie.* Erste Abtheilung. Nurnberg.

In 1794, a second volume of *Linnean Transactions* was published, in which are the following papers: the history and descriptions of four new species of *Phalæna* by Mr J. Beckwith; a new arrangement of the genus Papilio of Linné, by W. Jones, which is so interesting, as coming from such excellent authority, that we cannot refrain from laying before our readers an account of his innovations. The object of his paper was, to point out that the shape of the wings, (which forms a principal character with Linné in his distribution of the families of that genus,) though various at first view, approach each other so gradually, that it is impossible to draw from them the distinguishing line between each family. Linné, he observes, was acquainted with about 274 species, whereas the writer of this memoir states, that he had seen above 1000 in different cabinets, and about 400 more in various publications; and from an attentive examination of these, is induced to offer the following amendments to the characters of each of the Linnean families. Linnè describes the *Equites* as having "the upper wings longer from the posterior angle to the point than to the base; antennæ often filiform." He corrects the character thus: "Upper wings longer from the posterior angle to the point than to the base, occasioned by having four instead of three nerves, visible in every other family. The palpi often only a brush; under wings, with a connecting nerve in the centre, and without an abdominal groove."—*Heliconii*: "Wings narrow, entire, often naked, or deprived of scales; upper wings long; under ones short." *Linné*. To this character is added, that the upper wings have "a connecting nerve in the centre, very slightly grooved to admit the abdomen, which, with the antennæ, are generally long."—*Danii*: "Wings entire." *Linné*. To which Jones adds, "the under wings, with a connecting nerve in the centre, and a deep abdominal groove; palpi projecting."—*Nymphales*: "Wings denticulated." *Linné*. Jones adds, "the under wings without a connecting nerve in the centre, with a deep abdominal groove; palpi projecting."—*Plebei*: "Small *rurales*; spots on wings obscure." *Linné*. Jones adds, "Thorax and abdomen slender; under wings with no connecting nerve; antennæ clubbed;" and these he divides into two sections, those with long, weak, flexible tails; and those without tails, and having the wings entire.—*Plebeii urbiculæ*: "Spots on the wings generally transparent." *Linné*. Mr Jones divides these into three sections, thus: 1. Thorax and abdomen short, thick or broad; under wings without a connecting nerve; antennæ hooked at their points. 2. Upper wings pointed at their extremities, and long in proportion to their width. 3. Upper wings less extended, and, together with their under wings, more round; their margins entire.—To the Linnean families, Mr Jones adds another, which he terms *Romani*, which are generally of a large size, without the abdominal groove; no connecting nerve; antennæ generally sharpened; and the nerves in both wings extending from their base to their extremities nearly in straight lines. We cannot conclude our account of this ingenious arrangement, without observing, that Mr Jones has made a series of drawings for the gratification of himself and friends, of every species which he could obtain access to, in a very elegant and correct style.—In this volume Mr Marwich has given an account of Gmelin's *Musca Pumilionis*, to which some ingenious remarks are added by Mr Marsham.

Fuesly. In this year *Archives de l'histoire des Insectes publiées en allemand*, par Jean Gaspar Fuesly, *traduites en François*. Winterthur, in 4to.

Panzer. Panzer also published *Faunæ Insectorum Americæ Borealis prodromus*. Norimburgæ, in 4to. who also edited the following work:

J. E. Voet *Icones Insectorum Coleoptratorum &c. illustravit* D. G. Wolfgang, F. Panzer, &c. Erlingæ, in quarto.

Schneider. *Neuestes Magazin für die Liebhaber der Entomologie herausgegeben, von* D. H. Schneider. Stralsund, in octavo.

Dunker. In 1793 was published at Halle, in octavo, *Entomologisches Bilderbuch für junge Insektensamler, von* Johann. Heinr. August. Dunker.

Hoppe. And David Henrici Hoppe, M. D. *Enumeratio Insectorum Elytratorum circa Erlangam Indigenarum.* Erlangae, 8vo.

Lewin. William Lewin published in this year, *The Papilios of Great Britain* in quarto; in which he describes in English, with very elegant figures, all the species of butterfly at that time known to inhabit these islands, which amounted to about sixty. We understand that the author intended to have figured all the Lepidoptera of Britain; but his untimely death prevented his proceeding farther than the Papiliones.

Latreille. Latreille in this year produced his *Precis du Caractére des Genres*, in which he divides insects into two sections, viz. those with and those without wings, and these he divides into the following orders: *Coleoptères, Orthoptères, Hémiptères, Neuroptères, Lépidoptères, Suceurs, Thysanours, Parasites, Acepheles, Entomostracés, Crustacés*, and *Myriapodes*; as he has completely altered this arrangement in his later works, we shall omit noticing this method farther, as it will be sufficiently obvious to the reader what these alterations are from the terms employed, &c.

Rossi. A new edition of Rossi's *Fauna Etrusca*, &c. was published at Helmstad, by Dr Joh. Christ. Lud Hellwig.

Francillon. Mr Francillon published a small tract on a new coleopterous insect, accompanied with a coloured figure. It is entitled, *Description of a rare scarabæus, from Potosi in South America; with engraved representations of the same, coloured from nature. Scarabæus macropus* is the name applied to the singular insect.

In 1795, was published *Insecto-Theology*, or a *Demonstration of the Being and Perfections of God, from a consideration of the Structure and Economy of Insects.* This is a translation of Lesser's work, mentioned before under the year 1742, with Lyonnet's notes, and a few others by the translator. Lond. 8vo.

Schrank. In 1796, appeared *Sammlung naturhistorischer und Physikalischer aufsatze von Frans von Paula Schrank.* Nürnberg. In octavo.

Hoppe. Hoppe produced his *Entomologisches Taschenbuch.* Regensburg. In octavo.

Jacobæo. And an interesting work in folio, *Museum Regium descriptum* ab Oligerio Jacobæo. Hafn.

Hubner. Jacob Hübner published his *Der Samlung Europaischer Schmetterlinge,* Ausburg, in quarto. But few copies of this beautiful work have reached this country, and, as we have not examined it with care, must refrain from giving our opinion on it. From what we have seen, it appears to be a valuable publication.

Dryander. The second volume of *Catalogus Bibliothecæ Historica naturalis, Josephi Banks, Baroneti,* by T. Dryander, comprehending the entomological works of that immense collection of books, was published in 1796. We cannot speak too highly of its contents, which are admirably arranged, in such a manner as to be in itself a valuable bibliothecal system of entomological writers.

Hennert. In 1797, C. W. Hennert published at Berlin a work in quarto, entitled *Ueber den Raupenfras und Winbrüch in den Jahren.*

Smith. And Dr J. E. Smith published a magnificent work in folio, in London, entitled *The Natural History of the rarer Lepidopterous Insects of Georgia; collected from the Observations of Mr John Abbott.* It is comprised in two volumes, with about an hundred plates; and the insects are represented in their different states, on one of the plants on which they feed. Mr Abbot, the gentleman from whose notes and drawings the work was formed, was an assiduous collector of insects residing in North America, from whom many of the London cabinets have received the most valuable specimens of the insects of those regions, in the highest state of preservation.

Reich. In the same year, *Mantissa Insectorum Iconibus illustrata, Species novas aut nondum depictas exhibens, fas.* 1. *auctore,* Godofredo Christiano Reich, &c. Norimbergæ. In octavo.

The third volume of the Transactions of the Linnean Society of London, containing some interesting entomological papers, appeared, as follow: Observations respecting some rare British insects, by W. Lewin;—a History of three Species of *Cassida,* by the Rev. William Kirby;—Observations on the Economy of *Ichneumon Manifestator,* by Thomas Marsham, Esq.—Observations on the Insects that infested the Corn in the year 1795, by Thomas Marsham, Esq.—lastly, a most interesting and ingenious paper on the *Oestrus,* or Gad-fly, by Bracy Clark, Esq.

Fabricius. In 1798, Fabricius published the supplement to his *Entomologia Systematica;* which presents an outline of his system in its latest state; and being the result of such extensive knowledge as he possessed, demands a considerable share of our attention. He, in this work, divides insects into thirteen classes, as follow:

Class 1. ELEUTHERATA. Jaws naked, free, bearing palpi.

Class 2. ULONATA. Jaws covered with an obtuse galea or mouth-piece.

Class 3. SYNISTATA. Jaws elbowed near the base, and connected to the lower lip.

Class 4. PIEZATA. Jaws horny, compressed, and usually elongated.

Class 5. ODONATA. Jaws horny and toothed; two palpi or feelers.

Class 6. MITOSATA. Jaws horny, arched; no palpi.

Class 7. UNOGATA. Jaws horny, unguiculated.

Class 8. POLYGNATA. Jaws many, (generally two) within the lip.

Class 9. KLEISTAGNATHA. Jaws several, without the lip.

Class 10. EXOCHNATHA. Jaws several, outside the lip, but covered by the palpi.

Class 11. GLOSSATA. Mouth composed of a spiral tongue, situated between the two palpi.

Class 12. RHYNGOTA. Mouth composed of a beak, or articulated sheath.

Class 13. ANTLIATA. Mouth composed of a sucker, not jointed.

Clairville. In the same year, viz. 1798, Clairville published an octavo work on the insects of Switzerland, in which he proposes to divide insects into eight orders, nearly after the system of Linné; but he distinguishes them by different names, and denominates them sections instead of orders. The names are, *Elythroptera, Dictyoptera, Phleboptèra, Halteriptera, Lepidoptera, Hémimeroptèra, Rophopteira,* and *Pododunera.* The work is entitled, *Entomologie Helvétique, ou catalogue des Insectes de la Suisse, &c. avec Descrip. et Figures.* Zurich.

In the fourth volume of the Linnean Transactions, we find, an Essay on the Eye-like spot in the Wings of the *Locustæ* of Fabricius, as indicating the male sex; by Professor Anthony Augustus Henry Lichtenstein;—Account and Figure of a minute *Ichneumon*; by G. Shaw, M. D.—*Amophila,* a new genus of Hymenopterous insects, including the *Sphex sabulosa* of Linné; by Rev. William Kirby;—Further Observations on the Wheat Insect, in a Letter to the Rev. Samuel Goodenough, by T. Marsham, Esq.—History of *Tipula Tritici,* and *Ichneumon Tipulæ,* with some observations upon the Insects that attend Wheat; in a letter to Thomas Marsham, Esq. by the Rev. William Kirby;—Observations on the genus *Pausus,* and Description of a new Species; by Adam Afzelius, M. D.

Donovan. E. Donovan this year published in London, *Natural History of the Insects of China,* which is the first work on the entomological productions of that vast empire that has appeared. The materials composing this volume, (which is in 4to.), and from which it was in a great manner formed, were obtained from the first and most authentic sources, including many of the species collected at the time of the embassy of Lord Macartney, with many others obtained from the cabinets of the highest celebrity, and the communications of friends. The work is illustrated by fifty copper-plates, beautifully coloured. It has been translated into the French and German languages on the continent.

Cederhiel *Faunæ Ingricæ Prodromus, exhibens methodicam Descriptionem Insectorum agri Petropolensis, &c. auctore* J. Cederhielm, Leipsiæ.

And *Verzeichniss der Käfer Prussens entdorfen von Johann Gottlieb, von Johann Karl Wilhelm Illiger, &c.* Halle, in 8vo.

Also Busch Webersicht, (*Almanack*) *der fortschrifte in Wissench.* Erfurt, in 8vo.

Likewise, *Naturgeschichte der schädlichen Nadelholz-Insecten, nebst Anweisung zu ihrer Vertilgung, (Ein nützliches Lesebuch für Naturforscher, Forstmänner und Oekonomen).* Von Georg. Gottfr. Zinke. Weimar, in 8vo.

Voigt, in this very fertile year, published his *Magazin für den neuesten Zustand der Naturkunde mit Büschricht auf die dazu gehörigen Hülfwissenschaften.* Von Joh. Heinr. Voigt. Weimar, in 8vo.

Schrank also published his *Fauna Boica Durchgedachten Geschichte der in Bajern einheimischen und Zahmen Thiere.* Nurnberg, in 8vo.

In the same year, Paykull published his valuable treatise on the insects of Sweden, entitled, Gustave Paykull *Fauna Suecica, Insecta,* Upsaliæ, in three octavo volumes.

In 1799, a very useful work, entitled, *Europäische Fauna oder Naturgeschichte der Europäischen Thiere.* Von J. A. E. Goeze, &c. Kaefer, Leipzig, in 8vo.

And Christian Crutzer *Entomologische Versuche.* Wien, in 8vo.

In 1800, the science of entomology was considerably advanced, by a vast number of very valuable works.

Cuvier, with the assistance of Dumeril, published in Paris his *Anatomie Comparée,* in which the organization of insects is treated of at great length, and a new systematic arrangement is proposed, and insects are divided into two great sections; those with, and those without, jaws. In the first, are included the orders *Gnathaptères, Neuroptères, Hymenopteres, Coleopteres,* and *Orthopteres*; in the second, *Hemipteres, Lepidopteres, Dipteres,* and *Apteres.*

In the 5th volume of the Transactions of the Linnæan Society, published this year, we find two interesting papers, viz. a continuation of the history of *Tipula Tritici,* by the Rev. W. Kirby; and some observations on insects which prey upon timber, with a short history of *Cerambyx Violaceus* of Linné, by the same gentleman; both these communications are accompanied by plates.

In this year, Thunberg published his *Museum Naturalium Academiæ Upsalensis, &c.* in 4to.

And E. Donovan published his *Insects of India,* in 4to; and, like the *Insects of China,* embracing in a general, yet scientific view, a comprehensive display of the most rare and beautiful insects peculiar to those fertile regions.

Also Walther's *Forstphysiographie Herborn, &c.*

In the same year *Archiv für Zoologie und Zootomie.* Von C. R. W. Wiedmann. Berlin and Braunschweig, in four octavo volumes.

And the *Verzeichniss meiner Insecten Samlung oder Entomologisches Handbuch für Liebhaber und Samler.* Von Jacob Sturm, Erste Heft. Nurnberg, in 8vo.

Lastly, the 5th volume of *Bibliotheca Hist. Nat. Banksianæ,* by Dryander, contains some references to the works of entomological writers.

History. In 1801, a most interesting publication appeared in Paris, by the celebrated Professor of Zoology, Lamarck, entitled *Systeme des Animaux sans Vertebres,* in which we find considerable improvements in the entomological department. He removes the greater number of the Linnæan aptera to two other classes, viz. CRUSTACEA and ARACHNIDES. See our article CRUSTACEOLOGY. The INSECTA he divides into three subclasses: 1. Those with mandibles and maxillæ; 2. Those with mandibles and trunk; 3. Those without mandibles, but having a trunk or sucker. In the first, he places the orders *Coleopteres, Orthopteres,* and *Neuropteres*; the second is merely confined to the *Hymenopteres*; and in the third, the *Lepidopteres, Hemipteres, Dipteres,* and *Apteres,* (which last contains but one genus, viz. *Pulex,* the flea). His subdivisions of the orders we shall have occasion to notice hereafter at length.

Fabricius. Fabricius also published his *Systema Eleutheratorum Killiæ,* in two octavo volumes.

Illiger. And Illiger produced his *Magazin fur Insectenkunde herausgegeben von* Karl Illiger. Braunschweig, in octavo.

Knoch. Likewise *Neue Beytrage zur Insectenkunde.* Von August. Wilhelm. Knoch. Leipsig, in octavo.

Weberi. Another interesting work, Frederici Weberi *Observationes Entomologicæ, continentes novorum, quæ condidit generum characteres, et nuper detectarum Specierum descriptiones.* Kiel, octavo.

Sturm. Lastly, Jacob Sturm's *Abbildungen zu Kare Illiger's Ueberſetzung von Olivier's Entomologie oder Naturgeschichte der Insecten.* Nurnberg, in quarto.

Latreille. In 1802, several works appeared in this country, and two in Paris, highly interesting, especially to the natural systematist. We may first notice *Histoire Naturelle des Fourmies, et recueil des Mémoires, et des Observations sur les Abeilles, les Araignés, les Francheurs et autres insectes.* Par P. A. Latreille, &c. Paris, octavo.

Kirby. The Rev. William Kirby this year produced that excellent work, entitled, *Monographia apum Angliæ,* &c. in two octavo volumes. Our author proceeds to point out his reasons for taking up this subject, and under the head of Introductory Remarks, gives us a minute account of the rise and progress of this department of entomology, with remarks on the various works treating on this subject, with definitions of the terms used in describing the genera and species by different authors; and after pointing out the confusion which reigned throughout the order Hymenoptera, gives us a new set of terms, with comments on terminology in general. The characters of the order Hymenoptera, with the generic characters and divisions of families, are next given, intermixed with the economy of each family and subdivision. Under the head of Addenda, we have some interesting remarks on other hymenopterous genera; and at the end of the first volume, a series of plates explaining the various parts of the mouth, &c. peculiar to each family and subdivision. The second volume treats of the species, with occasional remarks on the peculiar economy of each. The descriptions are laboured, and extremely accurate. It is certainly the most scientific work which has appeared in any branch of natural history in this country. In the work of Latreille, which we have mentioned above, we find the same divisions as those instituted by Mr Kirby; they differ merely in terms, Latreille considering each of Mr Kirby's subdivisions as a distinct genus. We wish we had room to give a complete account of this interesting publication, but we have already far exceeded our limits in this department of the article, and shall therefore lay before the reader as much of that valuable work as we can find room for, under the proper head, in our descriptions of the species.

Marsham. Thomas Marsham, Esq. the oldest of the British en-

History.

Sepp's *Beschouwing der Wonderin Gods in de Miusgeachte Schepzelln of Nederlandsche Insecten.* Amsterdam. In three volumes, quarto.

Planches enluminées, par Daubenton le jeune. Folio. This work contains figures of several very rare insects, principally of the lepidopterous order.

Ephemerides Academiæ Cesareæ Naturæ Curiosorum. Quarto.

Erucarum Ortus, Alimentum et Paradoxa Metamorphosis, par Mariam Sibillam Merian. Amstelodami.

Johannis Eusebii *Voet Descriptiones et Icones Coleopterorum.* Quarto.

Lichtenstein *Catal. Mus. Holthuysen.*

Schriften d. Gesellschaft Naturforschender Freunde zu Berlin. Quarto.

Abhandlungen der Hallischen Naturforschenden Gesellschaft. Dessau und Leipzig. Octavo.

Nova Commentaria Petropolitana. Quarto.

George Heinrich Barowsky *Gemeinützige Naturgeschichte des Thierreichs.*

Bocks *Naturgeschichte von Preusen.* Tom. 5.

Dominicus Cyrilli *Entomologiæ Neapolitanæ Specimen.*

Johannio Leonhard Frischs *Beschreibung von allerley Insecten in Deutschland* 13 *Theile.* Quarto.

Gleditsch Einleitung in die Forstwissenschaft.

Hamburgisches Magazin, oder gesammlete Schriften aus der Naturforchung, &c.

Herbst *Gemeinnützige Naturgeschichte.*

Petri Löfling *Iter Hispanicum.* Octavo.

Georgius Maregraaf de Leibstatt *Historia Naturalis Brasiliæ.*

Piller et Mitterpacher *Iter per Poseg.*

Nicolas Robert *Species Florum Variæ, æneis tabulis.* Paris. Folio.

Neuer Schauplaz der Natur.

Schmeidleins Taschenbuch für Insectenfreunde.

CLASSIFICATION.

Classification.

By this term, we mean the distribution of insects into subclasses, orders, tribes, families, genera, and species; and we shall take our outline from the system proposed by Dr Leach, of which the following is a tabular view.

Subclass I. AMETABOLIA.

Insecta undergoing no metamorphoses.

Order I. Thysanura. Tail armed with setæ.

Order II. Anoplura. Tail without setæ.

Subclass II. METABOLIA.

Insects undergoing metamorphoses.

Century I. Elythroptera. Insects with elytra.

Cohors. I. Odontostoma. Mouth with mandibles.

* Metamorphoses incomplete.

Order III. Coleoptera. Wings transversely folded; elytra crustaceous, covering the wings, with the suture straight.

** Metamorphosis nearly coarctate.

Order IV. Strepsiptera. Wings longitudinally folded; elytra coriaceous, not covering the wings.

*** Metamorphoses semi-complete.

Order V. Dermaptera. Wings longitudinally and transversely folded; elytra somewhat crustaceous, abbreviated, with the suture straight.

Order VI. Orthoptera. Wings longitudinally folded; the internal margin of the elytron covering the same part of the other; elytra coriaceous.

Order VII. Dictuoptera. Wings longitudinally folded twice or more; elytra coriaceous, nervous, one decussating the other obliquely.

Cohors. II. Siphonostoma. Mouth with an articulated rostrum.

Order VIII. Hemiptera. Elytra somewhat crustaceous, or coriaceous; towards the apex generally membranaceous, horizontal, one decussating the other obliquely. Metamorphoses half complete.

Order IX. Omoptera. Elytra entirely coriaceous, or membranaceous, and meeting obliquely, with a straight suture. Metamorphoses semi-complete, or incomplete.

Century II. Medamoptera. Insects without wings or elytra.

Order X. Aptera. Mouth with a tubular sucking rostrum. Metamorphoses incomplete.

Century III. Gymnoptera. Insects with wings, but no elytra.

Cohors. I. Glossostoma. Mouth with a spiral tongue.

Order XI. Lepidoptera. Wings four, membranaceous, with pterigostea, covered with meal-like scales.

Cohors. II. Gnathostoma. Mouth with maxillæ and lip.

Order XII. Trichoptera. Wings four, membranaceous, with pterigostea, and hairy.

Cohors. III. Odontostoma. Mouth with mandibles, maxillæ, and lip.

Order XIII. Neuroptera. Four highly reticulated wings, generally equal in size; anus of the female without a sting, or compound borer.

Order XIV. Hymenoptera. Four venose wings, hinder ones smallest; anus of the female with a sting, or with a compound borer or oviduct.

Cohors. IV. Siphonostoma. Mouth tubular, formed for sucking.

Order XV. Diptera. Wings, and halteres or balancers two.

Subclass I. INSECTA AMETABOLIA.

Order I. THYSANURA.

Tail furnished with setæ, or filaments. Mouth with mandibles, palpi, labrum, and labium.

The bodies of the animals which compose this order, are generally covered with scales or hair. Their motion is extremely rapid, or performed by leaping.

Tribe I. Lepismides.

Palpi very distinct and prominent, or exserted. Antennæ composed of a vast number of very short joints. Tail with three exserted setæ.

Family I. *Lepismida.*

Body depressed, and moving with a running motion. Tail with three nearly equal filaments.

Genus I. Lepisma. Linn. De Geer, Fabr. Latr.

Setoura. Brown.

Forbicina. Geoff. Lamarck.

Antennæ inserted between the eyes. Maxillary palpi slender, composed of five joints, the last of which is elongate, and very slender. Labial palpi with their joints compressed, dilated, and round. Eyes small and remote.

Sp. 1. *Sacharina.* Body covered with silvery scales. *Lepisma sacharina.* Linn. Fabr. Latr.

La Forbicine plate. Geoff. *Hist. des. Ins.* ii. 613. plate 20. f. 3.

This is the only species known. It is very common amongst books, clothes, &c. and wanders about during the night. It is supposed to have been originally introduced into Europe from America, where it is said to live amongst sugar.

FAMILY II. *Forbicinida.*

Body convex, with an arched back formed for springing. Tail with three setæ, the middle one longest.

FORBI- NA. GENUS II. FORBICINA. Geoff.
LEPISMA. Linn. Oliv.
MACHILIS. Latr.

Antennæ inserted under the eyes, shorter than the body. Maxillary palpi thick, with six joints, the last conic. Labial palpi, with the apex membranaceous. Eyes large and contiguous.

lypoda. *Sp.* 1. *Polypoda.* Smoky brown, with obscure rust-coloured spots.
Lepisma polypoda. Linn.
Lepisma saccharina. Vill. *Ent.* 4. tab. 11. fig. 1.
Machilis polypoda. Latr. *Gen. Crust. et Ins.* i. p. 165. tab. 6. fig. 4. magnified.
La Forbicine cylindrique. Geoff.

Inhabits all the temperate parts of Europe, and is found in woods, and under stones.

PÆTRO- US. GENUS III. PÆTROBIUS. Leach.
LEPISMA. Fabr.?

Antennæ longer than the body, inserted under the eyes. Maxillary palpi six-jointed; the fifth joint inversely conic, the sixth conic. Labial palpi, with the last joint obliquely truncate, with the apex acute, and not membranaceous. Eyes large and contiguous.

aritimus. *Sp.* 1. *Maritimus.* Blackish, with golden scales. Feet yellowish. Setæ of the tail annulated with white.

Inhabits all the rocky shores of Britain. Dr Leach first observed this species on the Devonshire coast, and afterwards in Ireland, Scotland, and Wales. Can it be the *Lepisma polypoda* of Fabricius?

TRIBE II. PODURELLIDES.

Palpi not exserted, nor very conspicuous. Antennæ composed of four joints, the last sometimes formed of several other minute articulations. Tail forked, and bent beneath the abdomen.

PODURA. GENUS IV. PODURA. Linn. Geoff. De Geer, Fabr. Lam. Hermann.

Antennæ with the last joint solid, not articulated. Abdomen elongate, linear.

umbea. *Sp.* 1. *Plumbea.* Lead coloured, shining, with griseous head and feet.
Podura plumbea. Linn. Fabr. Lat.
Podure plumbée. De Geer.
La Podure grise commune. Geoff.

Inhabits Europe, under stones. A good figure may be found in Roemer's *Genera Insectorum*, tab. 29. fig. 2.

There are a vast number of species in this and the following genus, which are worthy of attention. Fabricius, who placed these two genera together without the slightest distinction, has described several species, to which we cannot refer, from not having studied his species, which we trust some future zoologist will be induced to examine.

SMYN- HURUS. GENUS V. SMYNTHURUS. Latr.
PODURA. Linn. Fabr. De Geer, Geoff.
uscus. *Sp.* 1. *Fuscus.* Body entirely brown.
La Podure brun enfumée. Geoff.
Podure brun, ronde. De Geer, *Mem. sur les Ins.* vii. 35. tab. 3. fig. 7, 8.
Podura atra. Linn.? Fabr.
Smynthurus fuscus. Latr.

Inhabits Europe, is common on the ground, and in damp hedges.

Sp. 2. *Viridis.* Body green. Viridis.
Podura viridis. Linn. Fabr.
La Podure verte aux yeux noirs. Geoff.
Smynthurus viridis. Latr.

Inhabits various trees in Europe.

ORDER II. ANOPLURA.

Tail without setæ or filaments. Mouth in some furnished with two teeth, (or mandibles?) and an opening beneath; in others with a tubulose, very short haustellum.

The animals of this order are parasitical, and were by Latreille placed in an order which he named *Parasita.* This name Dr Leach has changed for the sake of harmony, and also to render the name more easy of retention in the memory, the characters being drawn from the same parts.

Their motion is slow, and their nourishment is derived from the blood of mammalia, birds, and insects.

It is almost an established fact, that every species of bird (and probably mammiferous animal) has its own peculiar parasite; and there is no instance of the same species of louse having been observed on two distinct species of birds, although some birds (as the raven, oyster-catcher, &c.) are infested with several species of parasites. The importance of clearly ascertaining the truth, is such to the ornithologist, that Dr Leach has employed a considerable portion of time, for the purpose of investigating and of describing the species with accuracy, little more than a bare catalogue of names and habitats having been given in the works of Linnæus, Fabricius, and Gmelin. The result of his examinations he does not consider himself as able to communicate at present; but it is his intention, when the subject has arrived at maturity, to give a paper on this order to the Linnean Society of London.

TRIBE I. PEDICULIDES.

Mouth consisting of a tubulose, very short haustellum.

GENUS VI. PTHIRUS. Leach. 6. PTHI- RUS.
PEDICULUS. Linn. Redi, Latr. Fabr.

Anterior pair of feet simple, two hinder pair didactyle. Thorax extremely short, scarcely visible.

Sp. 1. *Inguinalis.* Body whitish. Inguinalis.
Pediculus inguinalis. Redi.
Pediculus pubis. Linn. Fabr. Latr.
Le morpion. Geoff.

Inhabits the pubes and eyebrows of men and women, especially of those of easy virtue, being commonly known under the titles crabs, crab-lice, &c.

GENUS VII. PEDICULUS. Linn. Fabr. De Geer, Geoff. Redi, Hermann, Lam. 7. PEDICU- LUS.

Feet all armed with a finger and thumb. Thorax composed of three distinct equal segments.

Sp. 1. *Humanus.* Body oval, lobate, white, and nearly immaculate. Humanus.
Pediculus humanus. Fabr. Linn. Latr.
Pou humain du corps. De Geer, *Mem. sur les Ins.* tom. vii. p. 67. plate 1, fig. 7.

Inhabits the bodies and garments of men, and is known by the name of the body-louse. On the continent of Europe, especially in Spain and Portugal, it is very abundant. In Britain it is of very rare occurrence, and may have been introduced from the neighbouring countries.

Cervicalis. *Sp.* 2. *Cervicalis.* Body oval, lobed, cinereous, with a black interrupted band on either side.

Le pou ordinaire. Geoff.

Pou humaine de la tête. De Geer, *Mem. sur les Ins.* vol. vii. p. 67. tab. 1. fig. 6.

Pediculus humanus var. Linn.

Pediculus cervicalis. Latr.

Inhabits the heads of man throughout Europe. In Britain it is extremely common, especially in the heads and upper part of the necks of children, whence they are extracted by means of a fine toothed comb, or are destroyed by rubbing calomel, mixed with a little fat, amongst the roots of the hair. This species has been by many authors confounded with the preceding species.

Tribe II. Nirmides.

Mouth with a cavity, and two teeth, or mandibles.

7. Nirmus. Genus VII. Nirmus. Hermann.

Ricinus. De Geer, Oliv. Lam. Latr.

Pediculus. Linn. Geoff. Fabr.

The character of this genus is given in that of the tribe. All the species inhabit birds. The term *ricinus* having been used in botany is rejected, and that of Dr Hermann's is adopted.

Cornicis. *Sp.* 1. *Cornicis.* Whitish; head heart-shaped; segments of the thorax on each side produced into a tooth; abdomen oval, transversely banded with brown.

Ricin de la Corneille. De Geer, *Mem. sur les Ins.* tom. vii. p. 76. plate 4. fig. 11.

Ricinus cornicis. Latr.

Inhabits the *Corvus cornix* of Linnæus.

Subclass II. INSECTA METABOLIA.

Order III. COLEOPTERA.

Order Coleoptera, Linn. Cuv. Lam. Latr.

Class Eleuterata, Fabr.

This order is divided into five great sections, from the general number of joints in the tarsi.

Section I. Pentamera.

The number of joints in the tarsi is generally five, but in some of the aquatic genera the number is less.

Tribe I. Cicindelides.

Maxillary palpi four, the interior ones two-jointed. Labial two. Antennæ filiformes. Maxillæ furnished at their extremities with a distinct articulated hook. Mandibles with many teeth. Feet formed for running; hinder ones with trochanters.

Mentum broadly notched; internal side of the anterior tibiæ never notched; antennæ not moniliform.

8. Manticora. Genus VIII. Manticora, Fab. Oliv. Lam. Latr.

Carabus. De Geer.

Cicindela. Thunberg, Clairville.

Thorax somewhat heart-shaped. Abdomen very large, pedunculated, nearly inversely heart-shaped. Elytra embracing and shielding the whole of the abdomen, connected at the suture.

Antennæ inserted beyond the apex of the eyes, under a little process. Clypeus of the same size with the labrum. Labial and external maxillary palpi, with the last joint at the apex much compressed, and gradually a little broader. Scutellum scarcely visible.

Maxillosa. *Sp.* 1. *Maxillosa.* Black, with rough elytra.

Manticora maxillosa. Fabr.

Manticora maxillaris. Oliv. Latr.

Cicindela gigantea. Thun.

Carabe a tubercules. De Geer. *Mem.* 7. 623. pl. 46. fig. 14.

Inhabits the Cape of Good Hope, and is figured by Herbst's Archives, tab. 46. fig. 6.

9. Colliuris. Genus IX. Colliuris. Latr.

Collyris. Fabr.

Cicindela. Oliv.

Thorax long, cylindric-conic, narrow, attenuated in front. Abdomen long and narrow. Elytra not embracing the abdomen.

* With wings.

Sp. 1. *Longicollis.* Cyaneous; apex of the elytra notched; thighs red. Longicollis.

Collyris longicollis. Fabr.

Cicindela longicollis. Oliv.

Colliuris longicollis. Latr. *Gen. Crust. et Ins.* 1. tab. 6. fig. 8.

Inhabits Bengal.

** Without wings.

Sp. 2. *Aptera.* Black; elytra connected with the middle part rough; thighs red. Aptera.

Collyris aptera, Fabr.

Cicindela aptera, Oliv.

Colliuris aptera, Latr.

Inhabits the East Indies.

10. Megacephala. Genus X. Megacephala. Latr.

Gnatho, Illiger.

Cicindela, Linn. De Geer, Fabr. Oliv.

Thorax short, cylindric. Elytra convex-rounded. Labial palpi much longer than the external maxillary palpi.

* Elytra connected; no wings.

Sp. 1. *Senegalensis.* Black-green; antennæ and feet ferrugineous. Senegalensis.

Cicindela megalocephala, Fabr. Oliv.

Megacephala Senegalensis, Latr.

Inhabits Senegal.

** Elytra not connected; wings.

Sp. 2. *Carolina.* Purple-green; antennæ, mouth, a lunule at the apex of the elytra, and the feet ferruginous-yellowish. Carolina.

Cicindela Carolina, Linn. Fabr.

Megacephala Carolinensis. Latr. *Gen. Crust. et Ins.* 1. tab. 6. fig. 9.

Inhabits Carolina, where it is very abundant.

11. Cicindela. Genus XI. Cicindela, Linn. De Geer, Fabr. &c.

Buprestis, Geoff.

Thorax short. Elytra flat, rounded. External maxillary palpi as long as the labial. Antennæ inserted into the anterior margin of the eye. Clypeus shorter than the labrum.

Sp. 1. *Sylvatica.* Obscure æneous above; each elytron with an external lunule at the base, with a mark at the apex, and an intermediate transverse, narrow, sinuated band of white; with many impressed punctures near the suture. Sylvatica.

Cicindela sylvatica, Linn. Oliv. Latr.

Cicindèle des forêts. De Geer. *Mem.* 4. 114. tab. 4. fig. 7.

Inhabits Europe. Is found on Martlesome Heath, Suffolk, occasionally; near Christchurch, in Hampshire, it is very common.

Sp. 2. *Hybrida.* Coppery-green, or obscure copper-black above, often with a purple tint; each elytron with an external lunule at the base, another at the apex, with an intermediate transverse sinuous-toothed band of white; suture cupreous. Hybrida.

Cicindela hybrida. Linn. Oliv. Fab. Latr.

Cicindèle tachetée. De Geer, *Mem.* 4. 115. pl. 4. fig. 8.

Inhabits the sandy maritime plains of Europe; near bolia. Swansea, at Cromlyn Burrows, and on the sea-shore near Yarmouth, it is taken in profusion.

pestris. *Sp.* 3. *Campestris.* Green; sides of the head and thorax, with the thighs, coppery-purple; each elytron with four white marginal spots, and a fifth near the suture.

Cicindela campestris. Linn. Fab. Oliv. Latr.

Cicindèle champêtre. De Geer, *Mem.* 4. p. 118. pl. 4. fig. 1.

Inhabits the sandy plains and pathways of Europe, and is very plenty.

Tribe II. Carabides.

Maxillary palpi four, the interiores two-jointed. Labial two. Maxillæ bent at the apex, hooked without a distinct joint. Mandibles rarely with more than one tooth, which is towards the apex. Feet formed for running; hinder ones with a trochanter.

Mentum broadly notched. Internal edge of the anterior tibiæ often notched. Antennæ filiform, sometimes moniliform.

I. Body oblong, or ovoid. Labial palpi, inserted at the inferior sides of the lip. (*Observe.* The insects of this division do not live in the water.)

A. Anterior tibiæ notched in their internal edge.

a. Labial and maxillary palpi abruptly terminated, with a joint very different in size from the others. Antennæ straight.

Nothi- ilus. Genus XII. Nothiophilus. Dumeril.

Cicindela. Linn. Marsh.

Elaphrus. Fabr. Latr. Illig.

Palpi maxillary external and labial, with the last joint larger than the preceding joint, and somewhat cylindric.

Thorax flat, smooth, nearly quadrate, with the transverse diameter exceeding the longitudinal.

quaticus. *Sp.* 1. *Aquaticus.* Brown-brassy shining. Front corrugated. Elytra with punctured striæ, and a longitudinal smooth interval near the suture.

Cicindela aquatica. Linn. Marsh.

Elaphrus aquaticus. Fabr. Latr.

Inhabits pathways and the banks of ponds. *Cicindela semipunctata* of Linné, *Elaphrus semipunctatus* of Fabricius, &c. is the same species. There is a variety *β* of Paykull which has been taken in Norfolk and on the shore near Porto-Bello, Scotland, having little of the æneous lustre.

guttatus. *Sp.* 2. *Biguttatus,* may be at once distinguished by the whitish termination of its elytra.

Cicindela biguttata. Marsh.

Elaphrus biguttatus. Fabr.

Ela- rus. Genus XIII. Elaphrus. Fab. Latr. Dum. Illig.

Cicindela. Linn. Marsh.

Labial and external maxillary palpi, having the last joint longer than the preceding, and somewhat cylindric. Thorax truncate-obcordate, convex and unequal, with nearly equal diameters, or with the longitudinal rather the longest.

parius. *Sp.* 1. *Riparius.* Green or brownish bronze; elytra equally punctured, with impressed spots having a purple centre, with a pale green margin and coppery spot on each near the suture.

Elaphrus riparius. Fabr. Latr.

Cicindela riparia. Linn. Marsh.

Inhabits moist banks, and marshes every where.

ginosus. *Sp.* 2. *Uliginosus.* Coppery-æneous, with round cicatrices, more distinctly punctured, centres purple, margin green, elevated, with cupreous spots between.

Elaphrus uliginosus. Fabr. Latr.

Inhabits marshy and boggy ground. It is esteemed a rare species. It occurs in Battersea fields, near London, and in the banks of wet ditches on the borders of the Links near Edinburgh, in great numbers. Metabolia.

Genus XIV. Bembidium. 14. Bembidium.

Bembidion. Latr.

Cicindela. Linn. Marsh.

Carabus. Linn. Marsh. Fabr. Oliv.

Elaphrus. Fabr. Illig. Oliv.

Ocydromus. Frolich, Clairville.

Sp. 1. *Flavipes.* Thorax somewhat narrower than the head, equally broad and long, with very prominent eyes; body æneous above, black-green beneath. Elytra marbled with copper, with two impressed dots in each near the suture. Palpi, base of antennæ, and feet, yellowish. Flavipes.

Cicindela flavipes. Linn. Marsh.

Elaphrus flavipes. Fabr. Oliv.

Bembidion flavipes. Latr.

Inhabits the sandy shores of ponds and rivulets, but is not common in Britain.

Sp. 2. *Littorale.* Thorax somewhat broader than the head, truncate-obcordate, punctured and excavated at the angles. Body æneous black. Elytra with punctured striæ, and each with a humeral spot, another at the apex, and with the feet rufous. Littorale.

Carabus littoralis. Oliv.

Elaphrus rupestris. Illiger.

Bembidium littorale. Latr.

Inhabits France and Germany.

Observe. This genus contains a vast number of species, which require some distribution into sections.

b. Labial and external maxillary palpi not abruptly terminated by a joint distinct from the rest in size. Antennæ straight.

* Lip prominent; mandibles very strong, their internal edge prominent or toothed.

† Elytra not truncate.

Genus XV. Scarites. Fabr. Oliv. Lam. 15. Scarites.

Antennæ moniliform, third joint much longer than the second. Mandibles dentated on their internal edge. Lip short and broad, without auricles. Tibiæ, anterior ones palmated.

Sp. 1. *Gigas.* Black, shining. Thorax lunate, behind on each side with one dent. Elytra smooth, shoulders one-dentate. Mandibles sulcate, with the internal process large, dentate, with the apex acute. Gigas.

Scaritas gigas. Fabr. Oliv. Latr.

Inhabits Barbary and the south of France.

Genus XVI. Clivina. Latr. 16. Clivina.

Scarites. Fabr.

Tenebrio. Linn.

Carabus. Marsham.

Antennæ moniliform, second joint longer than the third. Mandibles without teeth on their internal edge. Lip elongate, with two auricles. Anterior tibiæ generally notched.

* Anterior tibiæ externally dentate.

Sp. 1. *Fossor.* Blackish or brunneous. Thorax somewhat quadrate, middle of the front impressed. Elytra with punctured striæ. Fossor.

Tenebrio fossor. Linn.

Scaritas arenarius. Fabr.

Clivina arenaria. Latr.

Carabus distans. Marsham.

Inhabits Europe under stones, especially in moist situations, where the ground is sandy.

** Anterior tibiæ, with obsolete teeth.

Sp. 2. *Gibba.* Black brown. Thorax nearly globose. Elytra with punctured striæ, smooth towards their apex. Feet paler. Gibba.

Scarites gibbus. Fabr.

Clivina gibba. Latr.

Inhabits France and England in moist or damp banks. In Battersea fields it is very common during the summer months.

17. Morion.

GENUS XVII. MORION. Latreille.

Antennæ moniliform, second joint much shorter than the third.

Monilicornis.

Sp. 1. *Monilicornis.* Plain, elongate, very black, shining; thorax on each side at the posterior angles impressed; elytra striated.

Inhabits the American islands.

18. Apotamus.

GENUS XVIII. APOTAMUS. Hoffmansegg, Latreille.

SCARITES. Rossi.

Antennæ filiform. Mandibles pointed. Exterior maxillary palpi very long and filiform; labial palpi much shorter and subulate.

Rufus.

Sp. 1. *Rufus.* See Rossi *Faun. Etrus.*

19. Siagona.

GENUS XIX. SIAGONA. Latr.

CUCUJUS. Fabr.

Antennæ somewhat setaceous. Mandibles pointed; the internal edge projecting. Labial and exterior maxillary palpi terminated by a nearly securiform joint.

Rufipes.

Sp. 1. *Rufipes.* Brunneous-black, punctate; thorax somewhat sulcate; antennæ and feet red.

Cucujus rufipes. Fabr.

Siagona rufipes. Latr. *Gen. Crust. et Ins.* tom. i. p. 209, tab. 7, fig. 9.

Inhabits Barbary.

20. Sphodrus.

GENUS XX. SPHODRUS. Clairville.

HARPALUS. Latreille.

CARABUS. Linn. Fabr. Marsh. Payk.

Antennæ not moniliform, with the third joint much elongate. External maxillary palpi with the last joint, save one, longer than the last.

Planus.

Sp. 1. *Planus.* Oblong, black more shining beneath; elytra with fine punctured striæ; trochanters of hinder thighs acute.

Carabus leucophthalmus. Lin. Marsh.

Carabus planus. Fabr.

Carabus spiniger. Paykull, Oliv.

Harpalus leucophthalmus. Latreille.

Sphodrus planus. Clairville.

Inhabits Europe. It is found in cellars and woods. The Linnean name is rejected as absurd, most of the *Carabides* having white eyes after death, but never whilst living.

21. Stomis.

GENUS XXI. STOMIS. Clairville.

HARPALUS. Latr.

CARABUS. Illig. Panz.

Antennæ not moniliform, with the third joint not longer than the following articulations. External maxillary palpi with the last joint somewhat cylindric longer than the one before it, a little attenuated at its base, and truncate at the apex.

Pumicatus.

Sp. 1. *Pumicatus.* Oblong, blackish brown; antennæ and feet rufescent; thorax with an impressed dorsal line, and a little groove on each side behind; elytra with punctured striæ.

Carabus pumicatus. Illig. Panz.

Inhabits France, Germany, and England, under stones.

22. Harpalus.

GENUS XXII. HARPALUS. Latr.

CARABUS. Linn. Fabr. Marsh.

Antennæ with the third joint a little longer than those which follow. External maxillary palpi with the two last joints equal in length, the last attenuated at the base and apex.

Ruficornis.

Sp. 1. *Ruficornis.* Head and thorax black; elytra obscure blackish brown, downy, punctulate, striated; thorax without foveolæ behind; antennæ and feet red.

Carabus ruficornis. Oliv. Panz. Marsh.

Harpalus ruficornis. Latr.

Inhabits Europe, under stones; the most common species of the genus.

23. Zabrus.

GENUS XXIII. ZABRUS. Clairville.

HARPALUS. Latr.

CARABUS. Fabr.

Antennæ not moniliform. External maxillary palpi with the last joint shorter than the one before it.

Tardus.

Sp. 1. *Tardus.* Black above, somewhat fuscous beneath; antennæ, tibiæ and tarsi brown; thorax without foveolæ, the hinder margin and abdomen widely punctured; elytra with punctured striæ.

Harpalus tardus. Latr.

Carabus gibbus. Fabr.

Inhabits the plains of France and Italy.

24. Trechus.

GENUS XXIV. TRECHUS. Clairville, Latr.

CARABUS. Linn. Marsh.

Antennæ not moniliform. Mandibles pointed. Exterior maxillary and labial palpi filiform, terminated by a sharp-pointed joint.

Meridianus

Sp. 1. *Meridianus.*

25. Licinus.

GENUS XXV. LICINUS. Latr.

CARABUS. Fabr.

Antennæ not moniliform. Mandibles very obtuse. Labial and external maxillary palpi terminated by a nearly secuniform joint.

Emarginatus.

Sp. 1. *Emarginatus.* Obscure black; elytra (without the aid of a lense) smooth.

Carabus cassidens. Fabr. Illig.

Licinus emarginatus. Latr. *Gen. Crust. et Ins.* tom. i. p. 199, tab. 7, fig. 8.

Inhabits Europe; but is very rare.

26. Badi ter.

GENUS XXVI. BADISTER. Clair. Latr.

CARABUS. Fabr.

Antennæ not moniliform. Mandibles very obtuse. Exterior maxillary palpi filiform; the labial palpi terminated by a thick short-ovoid joint.

Bipustulatus.

Sp. 1. *Bipustulatus.* Black; base of antennæ, feet, thorax, and wing-cases, red, the latter with a sutural lunate mark of black.

Carabus bipustulatus. Fabr.

Badister bipustulatus. Latr.

Inhabits France, Germany, and Britain.

** Elytra truncate at their extremities. Head and corselet narrower than the abdomen.

27. Anthia.

GENUS XXVII. ANTHIA. Web. Fabr. Latr.

CARABUS. Oliv. Linn.

Thorax cordiform. Head not narrow behind. Neck not apparent. Palpi filiform. Lip projecting in the form of a horny tongue. Abdomen oval, convex.

Decemg tata.

Sp. 1. *Decemguttata.* Black; coleoptra with nine grooves, and ten white spots.

Carabus decemguttatus. Linn. Oliv.

Anthia decemguttata. Latr.

Inhabits the Cape of Good Hope, where it is common.

28. Graphipterus.

GENUS XXVIII. GRAPHIPTERUS. Latr.

CICINDELA. De Geer.

ANTHIA. Fabr.

Thorax cordiform. Head not narrow behind. Neck not apparent. Palpi filiform. Lip nearly square, with the sides membranaceous, and rounded at the extremity. Abdomen orbicular, much depressed.

Multig tus.

Sp. 1. *Multiguttatus.* Black; front, sides of the thorax, and margins of the wing-cases and sixteen spots white tomentose; the marginal band of each elytron bidentate within.

4

Carabus multiguttatus. Oliv.

Anthia variegata. Fabr.

Graphipterus multiguttatus. Latr. *Gen. Crust. et Ins.* tom. i. p. 186, tab. 6, fig. 11.

Inhabits Egypt.

GENUS XXIX. BRACHINUS. Web. Fabr. Latr. Clair.

CARABUS. Linn. Marsh.

Thorax cordiform. Head not narrow behind. Neck not apparent. Palpi filiform. Lip nearly square, sides membranaceous, and terminated by a point. Abdomen parallelopiped. Tarsi with entire joints.

Obs. All the species of this genus have the power of emitting a smart sound, accompanied by an evolution of some gas, which they repeat two or three times at short intervals when they are first taken.

Sp. 1. *Crepitans.* Red-rusty; thorax narrowly truncate cordiform; elytra black-blue-green; abdomen blackish; antennæ, with the exception of the tips of the third and fourth joints, obscure blackish.

Carabus crepitans. Linn. Marsh.

Brachinus crepitans. Web. Fabr. Latr. Clairv.

Inhabits Europe under stones. It is rare in England. There is a small variety found in France and Germany, that has not hitherto occurred in Britain.

GENUS XXX. ECHIMUTHUS. Leach.

CARABUS. Linn. Marsh. Fabr.

LEBIA. Latr.

BRACHINUS. Clairv.

Thorax short, cordiform, broader than long. Head not narrow behind. Neck not apparent. External maxillary palpi distinctly truncate; labial palpi with the last joint thicker. Abdomen nearly perfectly quadrate. Tarsi with the fourth joint bifid.

Sp. 1. *Cyanocephalus.* Intense blue-green; first joint of the antennæ, thorax, thighs, and tibiæ, red; elytra with punctured striæ, the spaces between the striæ punctulated; knees black.

Carabus cyanocephalus. Linn. Marsh. Fabr.

Lebia cyanocephala. Latr. *Gen. Crust. et Ins.* vol. i. p. 191, tab. 6, fig. 12.

Inhabits Europe under the bark of trees, and on hot dry banks.

GENUS XXXI. RISOPHILUS. Leach.

CARABUS. Linn. Fabr. Marsh.

LEBIA. Latr.

Thorax cordiform, a little longer than broad. Head a little narrowed behind. Neck not apparent. Palpi filiform, terminated with a thick ovoid truncate joint. Abdomen very much depressed. Tarsi with the fourth joint bifid.

Sp. 1. *Atricapillus.* Body pale yellowish: head black; mouth and thorax reddish; elytra obsoletely striated.

Carabus atricapillus. Linn. Fabr.

Lebia atricapilla. Latr.

Inhabits Europe under the bark of trees. In Britain it very frequently occurs, on the sandy plains which are thrown up from the sea, amongst the roots of junci and other plants which grow in those parts.

GENUS XXXII. LEBIA. Latr.

CARABUS. Linn. Fabr.

Thorax cordiform, a little broader than long. Head but little narrowed behind. Neck not apparent. Palpi filiform, terminated with a large ovoid, truncate joint. Abdomen much depressed. Tarsi with entire joints.

Sp. 1. *Quadrimaculata.* Thorax ferrugineous; head rugulose, black, with the mouth reddish; elytra striated, black, with two pale yellow spots on each; feet pale yellow.

Carabus quadrimaculatus. Linn. Fabr.

Lebia quadrimaculata. Latr.

Inhabits Europe under the bark of trees.

33. CYMINDIS.

GENUS XXXIII. CYMINDIS. Latr.

CARABUS. Fabr. Oliv. Marsh.

TARUS. Clairville.

Thorax cordiform. Head not narrowed behind. Neck not apparent. Exterior maxillary palpi filiform; labial palpi terminated by a large securiform joint. Body depressed. Tarsi with entire joints.

Humeralis.

Sp. 1. *Humeralis.* Black, punctate; antennæ, mouth, thorax, lateral margins of the elytra, the shoulders, and feet, red; elytra striated.

Carabus humeralis. Fabr. Oliv. Payk. Rossi.

Cymindis humeralis. Latr.

Inhabits France, Sweden, Germany, and England; but is extremely rare.

34. ZUPHIUM.

GENUS XXXIV. ZUPHIUM. Latr.

CARABUS. Ross. Oliv.

GALERITA. Fabr. Clairv.

Thorax cordiform. Head not narrowed behind. Neck very apparent. External maxillary and labial palpi terminated by a large nearly obconic joint. Body very much depressed.

Oleus.

Sp. 1. *Oleus.* Red, minutely punctate; head (mouth excepted) black; elytra brown, obsoletely striate, with common red spot at the base, and another at the apex.

Carabus oleus. Rossi *Faun. Etrus.* i. tab. 6, Fig. 2, Fabr.

Zuphium oleus. Latr.

Inhabits Italy and the southern parts of France.

35. GALERITA.

GENUS XXXV. GALERITA. Fabr. Latr.

CARABUS. De Geer, Oliv.

Thorax cordiform. Head narrowed, and lengthened behind. Neck very distinct. External maxillary and labial palpi terminated by a large securiform joint. Body not very much depressed.

Americana.

Sp. 1. *Americana.* Black; first joint of antennæ, thorax, and feet, ferrugineous; elytra black-blue.

Galerita Americana. Fabr. Latr. *Gen. Crust. et Ins.* tab. 7, fig. 2.

Inhabits North America. Is very well figured by Drury, in his *Illustrations of Insects*, tom. i. pl. 42. fig. 2.

36. DRYPTA.

GENUS XXXVI. DRYPTA. Latr. Fabr.

CARABUS. Ross. Marsh.

CICINDELA. Oliv.

Thorax cylindric. Head not narrowed or lengthened behind. Mandibles much elongated and very prominent. Exterior maxillary and labial palpi terminated by a large nearly obconic joint, (maxillary ones much lengthened). Lip elongate linear, with two auricles.

Emarginata.

Sp. 1. *Emarginata.* Blue, punctate, villose; mouth, antennæ, and feet, red; thorax with an impressed longitudinal line; elytra with punctured striæ; apex of the first, and middle of the third joint of the antennæ, brown.

Drypta emarginata. Fabr. Latr. *Gen. Crust. et Ins.* tom. i. p. 197, tab. 7, fig. 3.

Cicindela emarginata. Oliv.

Carabus dentatus. Ross.

Carabus chrysostomos. Marsham.

Inhabits France, Germany, Italy, and England. In the former and latter of these countries it is extremely rare. It has been taken near Hastings in Suffolk; specimens from that neighbourhood are preserved in Dr Leach's cabinet.

Metabolia.

37. ODACANTHA.

GENUS XXXVII. ODACANTHA. Payk. Fabr. Latr.
ATTELABUS. Linn.
CARABUS. Oliv.

Thorax cylindric. Head not lengthened or narrowed behind in any great degree. Mandibles not remarkably long or prominent. Palpi filiform.

Observation. The structure of the mouth and the general appearance of this genus is that of *Lebia*.

Melanura.

Sp. 1. *Melanura.* Green-blue; first joints of the antennæ, elytra (apex excepted), breast, and feet, pale-rusty-red; thorax distinctly punctured; elytra slightly and widely punctured, the punctures arranged into obscure striæ; knees, tarsi, and antennæ (base excepted), blackish.

Attelabus melanurus. Linn.
Odacantha melanura. Payk. Fabr.

Inhabits Europe. In Britain it occurs near Swansea, and near Norwich in considerable abundance.

38. AGRA.

GENUS XXXVIII. AGRA. Fabr. Latr.

Thorax nearly conic. Head much narrowed behind and lengthened. Palpi filiform, the labial ones with the last joint oval-round.

Observation. In the structure of the mouth, this genus makes a near approach to *Lebia*, from which it differs in having the last joint of the labial palpi more elongate. Latreille makes two divisions, which we suppose should constitute genera.

* Fourth joint of the tarsi bifid.

Ænea.

Sp. 1. *Ænea.* Thorax punctate; elytra bidentate.
Agra ænea. Fabr.
Agra cajennensis. Latr.

Inhabits South America.

** All the joints of the tarsi entire.

Surinamensis.

Sp. 2. *Surinamensis.* Brunneous; head and thorax black; antennæ intersected with white and black; elytra striated, with their apex bidentate; feet red.
Agra surinamensis. Latr.

Inhabits Surinam.

Pennsylvanica.

Sp. 3. *Pennsylvanica.* Black; elytra red, with punctured striæ at the base; marginal spot, another on the suture, and the tip, black; feet red; knees black.

Inhabits Pennsylvania.

** Lip not prominent; mandibles small, their internal edge neither toothed or prominent.

39. PANAGÆUS.

GENUS XXXIX. PANAGÆUS. Latr.
CARABUS. Linn. Fabr. Marsh.

Thorax orbicular. Head narrower than the abdomen, with very prominent globular eyes. Neck distinct. Abdomen large, nearly quadrate.

Crux-major.

Sp. 1. *Crux-major.* Black, deeply punctured; elytra red, with punctured striæ, and a cross, and tips black.
Carabus crux-major. Linn. Fab. Marsh. Panz.
Panagæus crux-major. Latr.

Inhabits Europe.

c. Labial and external maxillary palpi with the last joint cylindric-oval. Antennæ crooked. Mandibles short.

40. LORICERA.

GENUS XL. LORICERA. Latr.
CARABUS. Fab. Marsh.

Antennæ incurved, the first joints differing in size and in proportion from the others. Mandibles with the back notched and unidentate. Thorax nearly orbicular. Neck distinct.

Ænea.

Sp. 1. *Ænea.* Elytra with punctured striæ; the fourth stria from the suture with three foreæ.
Carabus pilicornis. Fab. Oliv. Marsh.
Loricera ænea. Lat. *Gen. Crust. et Ins.* 1. Tab. 7. fig. 6.

Inhabits France, Germany, and England.

Metabol

B. Anterior tibiæ not notched on their internal edge.

a. Lip very short, not projecting beyond the first joint of the palpi. External base of the maxillæ not remarkably ciliated. Abdomen more or less thick.

41. Cy
rus.

GENUS XLI. CYCHRUS. Fab. Payk. Latr.
CARABUS. De Geer, Oliv. Marsh.
TENEBRIO. Linn.

Mandibles narrow, very long, bidentate at their extremities. Elytra embracing the abdomen. Labial and external maxillary palpi with the last joint much compressed, concave and securiform, or rather spoon-shaped. Thorax somewhat cordate.

Rostrat

Sp. 1. *Rostratus.* Black, elytra sharply punctate-rugose.
Cychrus rostratus. Fabr. Latr.
Tenebrio rostratus. Linn.
Carabus rostratus. Marsh. Oliv.

Inhabits Europe. In England it is rather uncommon, but in Scotland it occurs very frequently under stones.

42. Calo
soma.

GENUS XLII. CALOSOMA. Web. Fabr. Latr.
CARABUS. Linn. De Geer, Oliv.

Mandibles neither very narrow or long. Thorax nearly orbicular. Abdomen nearly quadrate. Labial and external maxillary palpi with the last joint somewhat conic or triangular.

Sycophan

Sp. 1. *Sycophanta.* Violet-black; elytra gold or coppery green, with about sixteen punctured striæ on each, the intervals obsoletely intersected transversely, the fourth, eighth, and twelfth from the suture, with some impressed spots.
Carabus Sycophanta. Linn.
Calosoma Sycophanta. Fabr. Latr.

Inhabits the European woods. There are but few instances of its having occurred in this country, six specimens only being known to us that have been clearly ascertained to be British. Two of these from Ireland are preserved in the collection of Mr Sowerby; one in the collection of W. J. Hooker, Esq. of Halesworth; another in the museum of S. Wilkin, Esq. which was taken in the county of Norfolk with the preceding specimen; a fifth occurred in Devon, near Kingsbridge, which is now, with another specimen, in the collection of Dr Leach.

Calosoma Inquisitor of Fabricius is sometimes taken near London, and it has been taken by Dr Leach near Tavistock in Devonshire; but it must be esteemed a rare British insect. It is said sometimes to occur in plenty near Windsor, on the white thorn hedges, feeding on the larvæ of lepidopterous insects.

43. Cara
bus.

GENUS XLIII. CARABUS. Linn. Fabr. Oliv. Latr. Panz. Marsh.

Mandibles neither very narrow or long. Thorax cordiform, truncate, and notched behind. Abdomen ovate.

Obs. As the British species of this genus have been most sadly confused, we shall describe the species, for the purpose of correcting the errors of nomenclature, which Mr Marsham has tended not a little to increase.

Violace

Sp. 1. *Violaceus.* Black; margins of the thorax and elytra violet-copper; elytra finely rugulose, somewhat smooth; abdomen elongate oval.
Carabus violaceus. Linn. Fabr. Oliv. Marsh. Latr.

Inhabits Europe.

Carabus purpurascens is said to have been taken in Britain; but we have not been enabled to identify it with certainty.

Catenula
tus.

Sp. 2. *Catenulatus.* Black; margins of thorax and elytra violet; thorax broader than long, deeply emarginate behind; each elytron with about fourteen striæ; the fourth, eighth, and twelfth from the suture interrupted; the intervals with a distinct somewhat rugose line; abdomen oval.

Carabus catenulatus. Scop. Fabr. Latr.

Carabus intricatus. Marsh. Oliv.

Inhabits the south of France, Germany, and Britain It is sometimes found quite black, at other times with a tinge of fine violet. It is very plentiful in Ireland, Scotland, and England, especially in the two former countries.

Intricatus.

Sp. 3. *Intricatus.* Black violet above, black beneath; thorax narrow, with nearly equal diameters; elytra with irregular striæ, the intervals punctate-rugose; each elytron with three elevated catenulated lines.

Carabus intricatus. Linn. Latr.

Carabus cyaneus. Fabr. Panzer.

Inhabits Europe. Is common in Germany and Sweden, but is rare in France. There is but one instance of its having occurred in Britain; Dr Leach took a single specimen under a stone in a wood opposite the Virtuous-Lady Mine, on the river Tavy, below Tavistock in Devonshire, in the last week in May. It is singular, that Mr Marsham, (who has every opportunity of examining the Linnean cabinet,) should have confounded the former species with this, as it will in no way agree with the character.

Nemoralis.

Sp. 4. *Nemoralis.* Black; margin of the elytra and sides of the thorax violet; elytra obscure copper, rugulose, with three longitudinal rows of excavated spots.

Carabus nemoralis. Illig. Latr.

Carabus hortensis. Oliv. Marsh. Fabr.

Inhabits France and Germany.

Monilis.

Sp. 5. *Monilis.* Brassy-green or violet-black above, black beneath; each elytron with about fourteen elevated lines, two in the middle more distinct than the rest; the fourth, eighth, and twelfth from the suture catenulated; abdomen elongate-oval.

Carabus monilis. Fabr. Latr.

Carabus catenulatus. Marsh.

Inhabits England, France, and Germany. It varies in sculpture, those lines on each side of the entire line being very frequently uninterrupted.

Morbillo-us.

Sp. 6. *Morbillosus.* Brassy or black copper above, black beneath; each elytron with three ribs, one at the suture; the interstices with a catenulated line, and on each side of it, with a less distinct smooth punctate-rugose line; abdomen elongate-oval.

Carabus morbillosus. Fabr. Latr.

Carabus granulatus. Marsh.

Antennæ quite black; thorax often or generally cupreous or coppery; intermediate tibiæ with a reddish-tomentose line. It varies in colour, being sometimes violet, with the sides green, or entirely black-bronze.

Inhabits Europe, under stones.

rvensis.

Sp. 7. *Arvensis.* Coppery or black above; antennæ altogether black; each elytron with fourteen elevated lines, three slightly notched transversely; the fourth, eighth, twelfth from the suture catenulated; abdomen oval.

Carabus arvensis. Fabr. Illig.

Inhabits Germany, Sweden, and England.

b. Lip projecting as far as the first joint of the palpi; exterior base of the maxillæ distinctly ciliated; abdomen generally very flat.

4. NEBRIA.

GENUS XLIV. NEBRIA. Latr.

CARABUS. Linn. Fabr. Marsh. Schönher.

Lip nearly quadrate, not projecting as far as the labrum, nor tricuspidate at its extremity; labial palpi not twice as long as the head; mandibles but little dilated externally.

* Back very much depressed.

Complanata.

Sp. 1. *Complanata.* Pale-yellowish; elytra paler, striated with two transverse bands, composed of black lines.

Carabus complanatus. Linn.

Carabus arenarius. Fabr. Oliv.

Nebria arenaria. Latr. *Gen. Crust. et Ins.* vol. i. p. 221. tab. 7. *fig.* 6.

Inhabits the sandy maritime shores of France, Germany, and South Wales.

Brevicollis.

Sp. 2. *Brevicollis.* Black shining antennæ; palpi, tibiæ, and tarsi, brown; elytra with punctured striæ.

Carabus brevicollis. Fabr. Schönher.

Carabus infidus. Rossi.

Carabus rugimarginatus. Marsh.

Nebria brevicollis. Latr.

Inhabits Europe; is found under stones and under the bark of trees.

Carabus Gyllenhalli of Schönher, which was discovered as a native of Britain by Dr Leach, at the base of Ben Lomond in Scotland. Has since been taken in some plenty near Edinburgh, by the late Richard Rawlins, Esq. one of the most promising entomologists of our day. *Nebria sabulosa* has likewise been taken near Hull in Yorkshire, by W. Spence, Esq.

** Back convex. Gen. HELOBIUM, Leach's MSS.

Multipunctata.

Sp. 3. *Multipunctata.* Black-brassy above, black beneath; middle of each elytron with impressed diluted spots, in a double longitudinal series; the intervals somewhat catenated.

Carabus multipunctatus. Linn. Fabr. Oliv. Marsh.

Nebria multipunctata. Latr.

Helobium multipunctatum. Leach's MSS.

Inhabits the northern parts of Europe. In England it occurs near London occasionally, especially in Battersea-fields. It should be placed, in a natural series, next to ELAPHRUS, to which genus it approaches in habit and economy.

45. POGONOPHORUS.

GENUS XLV. POGONOPHORUS. Latr.

CARABUS. Linn. Fabr. Oliv. Marsh.

LEISTUS. Froelich, Clairville.

MANTICORA. Jurine.

Lip elongate, even to the labrum, the extremity with three spines; labial palpi twice as long as the head; mandibles with their external base much dilated.

Cæruleus.

Sp. 1. *Cæruleus.* Blue above; antennæ, mouth, tibia, and tarsi red-brown.

Carabus spinibarbis. Fabr. Panz.

Pogonopherus cæruleus. Latr. *Gen. Crus. et Ins.* 1. tab. 7. fig. 4.

Inhabits England, France, and Germany.

II. Body short ovoid, nearly hemispherical; labial palpi inserted nearly on the superior side of the lip. (*Obs.* These insects live near the water, and prepare the way to the following tribe.) Anterior tibiæ notched.

46. OMOPHRON.

GENUS XLVI. OMOPHRON. Latr.

SCOLYTUS. Fabr. Clairville.

CARABUS. Oliv.

Lip very small; labial palpi inserted on the superior margin of the lip.

Limbatum.

Sp. 1. *Limbatum.* Pale-ferruginous; vertex of the head, a spot behind the thorax, a humeral spot on the elytra, and the suture with two bands of green.

Scolytus limbatus. Fabr.

Omophron limbatum. Latr.

Carabus limbatus. Oliv.

Inhabits France and Germany, in moist situations.

TRIBE III. DYTICIDES.

This tribe is at once distinguished from the *Carabici*, by the superior length of the hinder legs, which are formed for swimming.

I. Labial and external maxillary palpi filiform.

A. All the tarsi with five joints, the last of which is longest.

47. Dyticus.

GENUS XLVII. DYTICUS. Geoff. Illig. Latr.

DYTISCUS. Linn. Fabr. Oliv. Lam.

Scutellum distinct; anterior tarsi of the male patelliform; elytra of the female sulcated; external maxillary palpi with the last two joints equal.

Marginalis.

Sp. 1. *Marginalis.* Ovate, olive-black above; luteous red beneath the scutellum, of the same colour with the elytra; clypeus, whole margin of the thorax, and border of the elytra, red clay-colour; bifurcatur of the sternum lanceolate.

Inhabits Europe.

Linnæus considered the sexes of this insect as distinct species, under the names *Dytiscus semistriatus* and *marginalis.*

Dytiscus circumflexus of Fabricius, the *flavoscutellatus* of Latreille, is very abundant near London. It is distinguished from *marginalis* by its more elongate shape, by the bifurcate processes of the sternum being spine-shaped, and by the colour of the scutellum, which is invariably ferruginous.

48. Colymbetes.

GENUS XLVIII. COLYMBETES. Clairville.

DYTISCUS. Linn. Fabr. Gyll.

DYTICUS. Latreille.

Scutellum distinct; anterior tarsi of the male dilated, but not patelliform; elytra of the female not sulcated; exterior maxillary palpi with the last joint longer than the one before it.

Bupustulatus.

Sp. 1. *Bupustulatus.* Oval, depressed, black; finely striated above the elytra with impressed points, which are obsolete; antennæ labrum, two frontal spots; anterior tibiæ and tarsi obscure red; eyes gray.

Dytiscus bipustulatus. Linn. Fabr.

Dyticus bipustulatus. Latr.

Dytiscus carbonarius. Gyll.

Inhabits the European waters every where.

49. Laccophilus.

GENUS XLIX. LACCOPHILUS. Leach.

DYTISCUS. Linn. Marsh. Gyll.

Scutellum, none. Antennæ, setataceous. Palpi, filiform.

Minutus.

Sp. 1. *Minutus.* Greenish-testaceous; legs yellowish.

Dytiscus Minutus. Linn. Marsh. Gyll.

Laccophilus Minutus. Leach.

Inhabits stagnant waters.

50. Noterus.

GENUS L. NOTERUS. Clairv. Latr.

DYTISCUS. Fabr. Marsh.

DYTICUS. Latr.

Scutellum, none. Antennæ, with a fifth or seventh joint dilated. Labial palpi, bifurcate.

Crassicornis.

Sp. 1. *Crassicornis.* Oval, convex, brown; head and thorax ferruginous; elytra sprinkled with impressed dots; antennæ of the male thick.

Dytiscus crassicornis. Fabr. Oliv.

Dyticus crassicornis. Latr.

Inhabits Germany and France. Thorax in each sex, with margined sides, with an impressed longitudinal line.

B. The four anterior tarsi, with four joints; no scutellum.

51. Hydroporus.

GENUS LI. HYDROPORUS. Clairville.

HYPHYDRUS. Illig. Duméril.

DYTISCUS. Marsh.

Body oval; the breadth exceeding the height.

Fusculus.

Sp. 1. *Fusculus.* Oval, plain, black, pubescent, finely punctulated; elytra fuscous; antennæ, feet, shoulders and external margins of the elytra, rufous.

Dytiscus fusculus. Illiger. Latr.

Inhabits the waters of Europe.

52. Hy-phydrus.

GENUS LII. HYPHYDRUS. Illig. Clairville.

HYDRACHNA. Fabr.

DYTISCUS. Linn. Marsh.

Body nearly globose; the height exceeding the breadth.

Ferrugineus.

Sp. 1. *Ferrugineus.* Obscure ferruginous, impunctate; the base of the elytra with an impression at the base of the suture.

Dytiscus ovatus. Linn.

Hydrachna gibba. Fabr.

Hyphydrus ferrugineus. Latr.

Inhabits Europe.

Dytiscus ovalis of Illiger, *Hydrachna ovalis* of Fabricius, differs from the above species, in having a more shining colour, in having the elytra darker and distinctly and widely punctured. May not the above be but sexual distinctions? Such is the opinion of Dr Leach, who could never find the sexes of each kind.

C. All the tarsi five-jointed; the first joint largest; with a scutellum.

53. Pelobius.

GENUS LIII. PÆLOBIUS. Schönher, Leach.

HYGROBIA. Clairville.

HYPHYDRUS. Latreille.

DYTISCUS. Marsham.

HYDRACHNA. Fabricius.

Antennæ with the first joint longer and thicker than the rest.

Hermanni.

Sp. 1. *Hermanni.* Black; head, transverse band on the thorax; base and border of the elytra and feet ferruginous.

Dytiscus Hermanni. Marsh. Oliv.

Hydrachna Hermanni. Fabricius.

Hyphydrus Hermanni. Latr. *Gen. Crust. et Ins.* 1. tab. 6. fig. 5.

Inhabits the marshes of France and England. The last segments of the abdomen, when rubbed against the elytra, produce a noise.

II. External maxillary and labial palpi subulate; hinder thighs covered at their base with a shield-shaped plate.

54. Ha-plus.

GENUS LIV. HALIPLUS. Latreille.

HOPLITUS. Clairville.

CNEMIDOTUS. Illiger.

DYTISCUS. Geoffroy, Marsham.

Scutellum, none; body oval, thick.

Impres

Sp. 1. *Impressus.* Yellowish or ferruginous; elytra with some obsolete abbreviated punctured striæ, and with blackish lines and spots.

Inhabits France, England and Germany.

TRIBE IV. GYRINIDES.

Internal maxillary palpi composed of one part. Antennæ very short. Eyes divides so as to appear as four. Four hinder feet compressed, foliaceous, formed for swimming.

55. G nus.

GENUS LV. GYRINUS. Linn. Fabr. Latr. Gyll.

Natat

Sp. 1. *Natator.* Oval; elytra with punctured striæ; the inflexed margin testaceous.

Gyrinus Natator. Gyll.

Inhabits stagnant waters.

TRIBE V. BUPRESTIDES.

Mandibles with their extremities entire. Antennæ filiform or setaceous, often pectinated or serrated. Body convex, not jumping.

I. Palpi filiform.

BU- ESTIS.

GENUS LVI. BUPRESTIS. Linn. Fabr. Latr.

Antennæ filiform, serrated in both sexes. Thorax with the hinder margin applied to the base of the elytra. Body cylindric, linear.

iguttata.

Sp. 1. *Biguttata.* Green above, blue-green beneath; scutellum transversely impressed; apex of the elytra serrated; a white villose spot on each side of the suture, and three on the sides of the abdomen.

Buprestis biguttata. Fabr. Oliv. Marsh. Latr.

Inhabits France and Germany. In England it is very rare, but was once observed in very great abundance, by Dr Latham, in Darentwood, Kent.

TRA- IYS.

GENUS LVII. TRACHYS. Fabr. Gyll.

Antennæ serrated and filiform. Thorax with the hinder margin lobed, and applied to the base of the elytra. Scutellum obsolete. Body short, ovate or triangular.

inuta.

Sp. 1. *Minuta.* Coppery-brown above; front impressed; elytra with slightly elevated spaces, and transverse undulating bands of white hair.

Buprestis minuta. Linn. Marsh. Latr.

Trachys minuta. Gyll. Fabr.

Inhabits the nut-tree and elm.

APHA- ISTICUS.

GENUS LVIII. APHANISTICUS. Latreille.

BUPRESTIS. Fabricius.

Antennæ massive.

margina- s.

Sp. 1. *Emarginatus.*

Buprestis emarginatus. Fabr.

II. Palpi terminated by a thick joint.

MELA- S.

GENUS LIX. MELASIS. Oliv. Fabr. Lam.

ELATER. Linn.

Tarsi with entire joints.

abellicor- s.

Sp. 1. *Flabellicornis.* Obscure blackish; antennæ, tibiæ, and tarsi red-brown; head punctate; thorax rough, with elevated punctures, having an impressed dorsal line; elytra finely rugulose and striated.

Elater buprestoides. Linn.

Melasis flabellicornis. Oliv. Panz. Fabr.

Melasis buprestoides. Latr.

Inhabits Germany and the south of France. In England it has been once taken, by Mr John Curtis of Norwich, a most industrious entomologist.

CERO- IYTUM.

GENUS LX. CEROPHYTUM. Latr.

Tarsi with the last joint bifid.

ateroides.

Sp. 1. *Elateroides.*

TRIBE VI. ELATERIDES.

Mandibles notched, or bifid at their extremities. Antennæ filiform. Body leaping. Hinder thighs with a trochanter.

ELA- ER.

GENUS LXI. ELATER. Linn. Fabr. Geof. De Geer, Fabr. Oliv. Lam.

Obs. This genus should be divided into several others, but the characters have not yet been developed. In Latreille's *Genera Crustaceorum et Insectorum*, we find several sections, of which we shall give some account. The last joint of the tarsi is not notched. The maxillary palpi much exserted.

* The last joint of the antennæ with the apex so abruptly acuminated as to give the appearance of a twelfth joint.

rrugi- us.

Sp. 1. *Ferrugineus.* Antennæ serrated; colour black. Thorax, with the exception of the hinder margin and elytra, red, finely punctated, pubescent; elytra with punctured striæ.

Elater ferrugineus. Linn. Fabr. Oliv. Panz. Marsh.

Inhabits rotten trees, especially willows. In Britain it is very rare. It sometimes occurs in Kent, varies in size, and occasionally is found with the thorax entirely black. This last variety is in Dr Leach's collection.

** Last joint of the antennæ oval or oblong, not abruptly acuminate.

1. Body not linear, but three times as long as broad; abdomen oblong-triangulate.

A. Antennæ (of the male at least) pectinated or serrated.

Sp. 2. *Castaneus.* Antennæ of the male pectinated; colour black; head and thorax red-tomentose; elytra yellow punctate-striated; apex black. Castaneus.

Elater Castaneus. Linn. Fabr. Panz.

Inhabits Europe.

B. Antennæ simple; joints conic.

Sp. 3. *Murinus.* Black-fuscous, clouded with cinereous down; thorax bituberculate; antennæ and tarsi red. Murinus.

Elater murinus, Linn. Fabr. Marsh.

Inhabits Europe. Is common on thistles.

2. Body linear, nearly four times longer than broad; thorax oblong-quadrate.

Sp. 4. *Marginatus.* Black; front retuse; antennæ, sides of the thorax, feet, anus, and hinder margins of the abdominal segments brownish-yellow; suture and outer margin of the elytra, black. Marginatus.

Elater marginatus. Linn. Fabr. Oliv. Marsh.

Inhabits Europe. Is found on various herbaceous plants in fields.

TRIBE VII. TELEPHORIDES.

Tarsi with the last joint but one bifid. Antennæ filiform, composed of ten joints. Elytra soft, flexible. Thorax nearly quadrate, or semicircular.

GENUS LXII. ATOPA, Paykull, Fabricius. 62. ATOPA.

CHRYSOMELA. Linnæus.

CISTELA. Olivier.

CRIOCERIS. Marsham.

DASCILLUS. Latreille.

Maxillary palpi filiform, with the last joint somewhat cylindric; labial palpi not bifurcate. Body ovate. Feet all simple.

Sp. 1. *Cervina.* Black, with cinereous down; antennæ, feet, and elytra, pale-yellow. Cervina.

Chrysomela cervina. Linnæus.

Atopa cervina. Paykull, Fabricius.

Dacillus cervinus. Latr. *Gen. Crust. et Ins.* i. 252. tab. 7. fig. 11.

Inhabits Europe.

GENUS LXIII. CYPHON. Fabricius, Paykull, Gyllenhall. 63. CYPHON.

ELODES. Latreille.

Maxillary palpi filiform, the last joint somewhat cylindric. Labial palpi bifurcate. Body sub-ovate or round-ovate. Feet with their tibiæ simple, and their thighs not thickened.

Sp. 1. *Pallidus.* Sub-ovate, pale-red, punctulated, pubescent, eyes, antennæ, with the exception of their base, apex of the elytra, and abdomen, blackish; thorax somewhat semicircular, transverse, lobate behind. Pallidus.

Cyphon pallidus. Fabricius.

Elodes pallida. Latr. *Gen. Crust. et Ins.* i. 253. tab. 7. fig. 12.

Inhabits Europe in moist places.

Sp. 2. *Fuscescens.* Somewhat round-ovate, yellowish- Fuscescens.

Metabolia. red-fuscous or blackish, pubescent; thorax short, transverse, anterior margin nearly strait; feet and base of the antennæ reddish.

Elodes fuscescens. Latreille.

Inhabits France, in Petit-Gentilli near Paris.

64. Scirtes. Genus LXIV. Scirtes. Illiger.

Cyphon. Paykull, Fabricius.

Elodes. Latreille.

Chrysomela. Linn. Marsham.

Maxillary palpi filiform, the last joint somewhat cylindric; labial palpi, bifurcate. Body ovate, inclining to round, convex. Feet, with their tibiæ, terminated with a strong spine. Hinder thighs thickened and formed for leaping.

Hemisphærica. *Sp.* 1. *Hemisphærica.* Black, smooth; thorax short, transverse, anterior margin somewhat concave; tibiæ, tarsi, and base of the antennæ, pale fuscous.

Cyphon hæmisphæricus. Fabr. Payk.

Elodes hæmisphærica. Latreille.

Chrysomela hæmisphærica. Marsham, Linn.?

Inhabits France, England, and Sweden.

65. Cupes. Genus LXV. Cupes. Fabricius, Latreille.

Palpi equal, the last joint truncate; maxillary palpi with their joints thick. Antennæ, cylindric, simple. Maxillæ, with a double process, the external linear, internal small. Mandibulæ with their points notched. Lip bifid. Body linear, solid, rigid. Feet short.

Capitata. *Sp.* 1. *Capitata.* Obscure fuscous, head unequal, reddish-yellow.

Cupes capitata. Fabr. Latr. *Gen. Crust. et Ins.* 1. 255. tab. 8. fig. 2.

66. Drilus. Genus LXVI. Drilus. Oliv. Lam. Latr.

Ptilinus. Fabr. Geoffroy.

Cantharis. Marsham.

Maxillary palpi with their apex acute; labial short, somewhat cylindric. Antennæ with their internal edge pectinated. Maxillæ with one process. Mandibles notched at their points. Body soft, anteriorly arcuate, inflexed.

Flavescens. *Sp.* 1. *Flavescens.* Black, pubescent, elytra yellowish.

Drylus flavescens. Oliv. Latr.

Cantharis serraticornis. Marsham.

Inhabits Europe. Is found in Darent Wood, Kent, amongst grass, in tolerable abundance.

67. Lycus. Genus LXVII. Lycus. Fabr. Oliv. Lam.

Cantharis. Linn.

Lampylis. Geoff. Marsh.

Mandibles with their entire end pointed. Antennæ compressed, more or less serrate, inserted near each other. Palpi of the maxillæ, with the last joint somewhat triangular, having their points broader. Head, with the mouth produced into a kind of rostrum. Maxillæ with one process. Elytra nearly of equal breadth. Thorax somewhat quadrate, the anterior margin transverse, strait.

Minutus. *Sp.* 1. *Minutus.* Elytra with four elevated lines; thorax black, with the margins much elevated; last joint of the antennæ reddish.

Lycus minutus. Gyllenhall.

Lampyris pucilla, Marsham.

Inhabits Sweden, Germany, and England in oak trunks. It is certainly De Geer's *Lampyre rouge à corselet tout noir.* Vol. iv. p. 46.

68. Omalisus. Genus LXVIII. Omalisus. Geoff. Oliv. Fabr. Lam.

Mandibles with their apex pointed and entire. Antennæ approximate, the joints cylindric-conic; the second and third smallest. Maxillary palpi with the last joint cylindric-ovate, apex truncate. Head exserted. Maxillæ with one process. Thorax nearly quadrate, a little narrower before, the hinder angles produced and sharp. Body hard.

Suturalis. *Sp.* 1. *Suturalis,* black; thorax with a double excavation or fossula behind; elytra blood-red, with the suture black, deeply punctate-striate.

Omalisus suturalis. Oliv. Fabr. Latr.

Inhabits Germany.

69. Lampyris. Genus LXIX. Lampyris. Linn. Geoff. De Geer, Fabr. Oliv. Lam.

Mandibles pointed at their tips, sharp, and entire. Antennæ approximate, the joints cylindric and compressed, the third of the same length as the following joints, the second small. Head concealed by the thorax. Mouth small. Maxillæ with a double process. Maxillary palpi with the last joint triangular-ovate, compressed, the apex acute. Eyes very large. Body soft, of the male, with elytra and wings; of the female, apterous. Thorax semicircular.

Spendidula. *Sp.* 1. *Spendidula.* Oblong-brown; margin of the thorax livid-yellow, anteriorly with a transparent spot on each side; abdomen with the margins of the segments, anus and feet yellowish; breast reddish.

Lampyris spendidula. Linn. Latr.

Inhabits Europe; has never been found in Britain.

70. Telephorus. Genus LXX. Telephorus. Schæf. De Geer, Oliv. Lam. Latr.

Cantharis, Linn. Fabr. Marsh. Gyll.

Mandibles, with their apex acute and entire. Antennæ distant. Joints cylindric, elongate. Maxillæ bifid. Body soft. Palpi, with their last joint securiform. Elytra, the length of the abdomen.

Fuscus. *Sp.* 1. *Fuscus.* Cinereous-black, mouth, base of antennæ, thorax, back of the abdomen, sides of the belly and anus, red; thorax with a black spot.

Cantharis fusca. Linn. Fabr.

Telephorus fuscus. Latr.

Inhabits Europe in the spring and beginning of the summer.

71. Malthinus. Genus LXXI. Malthinus. Latreille.

Cantharis. Linn. Fabr. Marsh.

Telephorus. Oliv. De Geer.

Antennæ distant, joints elongate, cylindric. Maxillæ bifid. Mandibles with their points entire, and very sharp. Body soft. Palpi with their last joint ovate, acute. Elytra shorter than the abdomen. Head attenuated behind more or less.

Ruficollis. *Sp.* 1. *Ruficollis.* Head not very much attenuated behind; thorax not broader than long, distinctly margined behind; body blackish; head black; the two first joints of the antennæ and thorax red; elytra with some obsolete striæ towards the suture, the apex and two pectoral spots yellow; base of the feet, anterior thighs, and tibiæ, and knees of the middle feet, fuscous; middle of the anus reddish.

Malthinus ruficollis. Latr.

Inhabits France.

Marginatus. *Sp.* 2. *Marginatus.* Head but little attenuated behind; thorax broader than long, margined all round; body blackish; base of the antennæ, whole margin of the thorax, and two pectoral spots, red-yellow; elytra somewhat smooth, yellow at their points; base of the feet and knees pale; abdomen with the sides and margins of the segments red-yellowish.

Cantharis biguttata. Panzer.

Inhabits France and Germany.

Flavus. *Sp.* 3. *Flavus.* Head much attenuated behind; thorax not broader than long, margined nearly all round, the middle longitudinally impressed; body yellowish;

letabolia. antennæ (base excepted,) vertex, and dorsal mark of the thorax, blackish; elytra with punctured striæ, yellow at their points.

Telephorus minimus. Olivier.

Malthinus flavus. Latr.

Inhabits France and England, in the oak.

llaris. *Sp.* 4. *Collaris.* Head much attenuated behind; thorax not broader than long, distinctly margined behind, and with a short impression; body yellowish; antennæ (base excepted,) head behind, middle of the thorax, blackish; elytra smooth, somewhat fuscous, base darker, apex yellow.

Inhabits France.

Tribe VIII. Melyrides.

Tarsi with the last joint but one not bifid. Mandibles notched. Maxillæ bifid. Antennæ filiform, composed of ten joints. Elytra soft, flexible. Thorax quadrate, or semicircular.

. Mely- s. Genus LXXII. Melyris. Fabr. Oliv. Lam. Latr.

Head ovate, much inflected under the thorax. Antennæ with the second and third joints nearly cylindric, the former elongate; the fourth and following joints turbinated or conic. Tarsi with the outer nails beyond the middle beneath distinctly unidentate. Body oval. Thorax somewhat trapeziform, plain, narrower before.

ridis. *Sp.* 1. *Viridis.* Green, with three elevated lines on each elytron.

Melyris viridis. Fabr. Latr. Oliv.

Inhabits the Cape of Good Hope.

. Zygia. Genus LXXIII. Zygia. Fabr. Oliv.

Head ovate, much inflexed under the thorax. Antennæ with the second and third joints somewhat cylindric, more slender, the former elongate; the fourth and following joints dentate-serrated, compressed, somewhat transverse. Tarsi with the outer nails beneath under the apex obsoletely unidentate. Body oval. Thorax somewhat trapesiform, anteriorly narrower, the middle elevated.

longa. *Sp.* 1. *Oblonga.* Red; head and elytra blue or blue-green.

Zigia Oblonga. Fabr. Latr. *Gen. Crust. et Ins.* 1. 264. tab. 8. fig. 3.

Inhabits Syria and the kingdom of Murcia in Spain.

. Dasy- :s. Genus LXXIV. Dasytes. Payk. Fabr. Latr.

Melyris. Oliv. Lam. Illig.

Head somewhat transverse, retracted within the thorax even to the eyes. Tarsi with nails apparently bifid. Antennæ with short turbinated joints, nearly as broad as long. Lip with the apex deeply notched, almost bifid. Body without papillæ.

r. *Sp.* 1. *Ater.* Oblong, black, widely punctate, hairy, the hairs black and cinereous. Head with a double impression in front, which is ovate and roughish.

Dasytes ater. Latr. Fabr.

Melyris ater. Olivier.

Inhabits Europe, amongst grass.

Mala- ius. Genus LXXV. Malachius. Fabr. Oliv. Lam. Latr.

Cantharis. Linn. Marsh.

Telephorus. Schæffer, De Geer.

Head somewhat transverse, retractile even to the eyes within the thorax. Tarsi with apparently bifid nails. Antennæ with conic or cylindric-conic joints, longer than broad, in some few pectinated. Labium with apex entire, or scarcely notched. Body with two papillæ on each side, one under the anterior angle of the thorax, the other at the base of the abdomen.

Metabolia. Æneus. *Sp.* 1. *Æneus.* Brassy-green; head anteriorly red-yellowish; elytra blood-red, with the base and half the suture brassy-green.

Malachius æneus. Fabr. Latr. Oliv. Gyll.

Cantharis ænea. Linn. Marsham.

Inhabits Europe.

76. Hylæcætus. Genus LXXVI. Hylæcætus. Latr.

Cantharis. Linnæus.

Lymexylon. Fabr. Oliv. Paykull.

Antennæ serrated, the fourth, fifth, and following joints nearly equal. Elytra covering the back of the abdomen. Thorax broader than long. Head vertical. Body linear cylindric.

Dermestoides. *Sp.* 1. *Dermestoides.* Pale red; eyes and breast black; or black elytra brown-black or testaceous with a black apex; antennæ, feet, and apex of the abdomen testaceous reddish.

Hylæcatus dermestoides. Latr.

Inhabits Germany.

The sexes of this insect seem to have been considered as distinct species. See Latr. *Gen. Crust. et Ins.* 1. 266.

77. Lymexylon. Genus LXXVII. Lymexylon. Fabr. Oliv. Payk. Latr.

Cantharis. Linn.

Elateroides. Schæff.

Head vertical. Body linear cylindric. Thorax longer than broad, nearly cylindric. Elytra nearly covering the whole elytra. Antennæ simple, somewhat fusiform, the middle joints rather largest.

Navale. *Sp.* 1. *Navale.* Head black; thorax entirely or partly, elytra or their base testaceous; under part of the body and the feet yellowish.

Lymexylon navale. Fabr. Oliv. Latr.

Cantharis navalis of Linnæus, who (as we have already mentioned in our history of entomological writers) wrote a dissertation on this destructive insect. The male, Fabricius has considered as distinct, under the title of *Lymexylon flavipes.*

Inhabits in the oak of Europe, which it destroys.

78. Atractocerus. Genus LXXVIII. Atractocerus. Palissot-Beauvois, Latr.

Necydalis. Linn.

Lymexylon. Fabr.

Head vertical. Body linear, cylindric. Thorax nearly quadrate. Elytra very short. Antennæ simple, somewhat fusiform, the middle joints somewhat largest.

Necydaloides. *Sp.* 1. *Necydaloides.* Head and thorax fuscous, with a longitudinal yellowish line.

Atractocerus necydaloides. Palissot-Beauvois, Latr.

Necydalis brevicornis. Linn.

Lymexylon abbreviatum. Fabr.

Inhabits Guinea.

Tribe IX. Tillides.

Antennæ thicker at their extremities, serrated in some, solid in others. Elytra covering the whole abdomen. Body cylindric. Thorax narrow behind.

Family I. *Tillida.*

Tarsi, with the first joint very apparent, longer than the one before it.

79. Enoplium. Genus LXXIX. Enoplium. Latreille.

Tillus. Oliv. Panz. Fabr.

Dermestes. Rossi.

Palpi filiform. Antennæ, with the three last joints much dilated, serrated. Thorax nearly quadrate.

Serraticorne. *Sp.* 1. *Serraticorne.* Black. Elytra testaceous.

Metabolia. *Dermestes dentatus.* Rossi.

Tillus serraticornis. Olivier.

Enoplium serraticorne. Latreille.

Inhabits Italy.

Sp. 2. *Weberi.* Black. Thorax red. Elytra blue.

Tillus Weberi. Fabr.

Enoplium Weberi. Latreille.

Inhabits Germany.

80. Tillus. Genus LXXX. Tillus. Oliv. Fabr. Marsh. Latr.

Chrysomela. Linnæus.

Clerus. Fabricius, Olivier.

Maxillary palpi filiform. Labial palpi securiform. Antennæ nearly completely serrated. Thorax cylindric, or somewhat cordate.

* Thorax cylindric.

Elongatus. *Sp.* 1. *Elongatus.* Black, villous. Thorax red, black before.

Tillus elongatus. Fabr. Marsh. Oliv. Latr.

Chrysomela elongata. Linnæus.

Inhabit rotten trees.

T. ambulans is a mere variety of this species.

** Thorax subcordate.

Unifasciatus. *Sp.* 2. *Unifasciatus.* Black, pubescent. Elytra red at their base, with a white transverse band in the middle.

Clerus unifasciatus. Fabr. Oliv.

Tillus unifasciatus. Latr.

Inhabits France, Germany, and England.

81. Thanasimus. Genus LXXXI. Thanasimus. Latreille.

Clerus. Geoff. De Geer, Fabr. Oliv.

Attelabus. Linnæus.

Cleroides. Schæffer.

Maxillary palpi filiform. Labial palpi securiform. Antennæ with their extremities thick, and not serrated. Thorax somewhat cordate.

Formicarius. *Sp.* 1. *Formicarius.* Black. Thorax and base of the elytra red. Elytra, with two white transverse bands.

Attelabus formicarius. Linnæus.

Clerus formicarius. Fabricius, Olivier, Marsham.

Clerus fasciatus. Fourcroy.

Inhabits Europe in trees.

Family II. *Clerida.*

Tarsi, with the first joint very short, the upper part concealed by the base of the second articulation.

82. Opilus. Genus LXXXII. Opilus. Latreille.

Attelabus. Linnæus.

Clerus. Geoffroy, De Geer, Olivier.

Notoxus. Fabricius.

Eupocus. Illiger.

Palpi securiform. Antennæ with the ninth and tenth joints obconic, the last oval, obliquely truncate. Eyes not notched. Thorax conic-cylindric, narrower behind.

Mollis. *Sp.* 1. *Mollis.* Fuscous, villous. Base and apex of the elytra, and a middle transverse band, with the under part of the thighs yellowish gray. Abdomen red.

Notoxus mollis. Fabricius.

Clerus mollis. Oliv. Marsh.

Eupocus mollis. Illiger.

Attelabus mollis. Linnæus.

Opilus mollis. Latreille.

Inhabits Europe, under the bark of trees, especially of willows, eating the larvæ of other insects.

83. Clerus. Genus LXXXIII. Clerus. Geoff. Oliv. Lam. Latr.

Attelabus. Linnæus.

Trichodes. Herbst, Fabricius.

Maxillary palpi terminated by an obconic joint. Labial palpi, with the last joint securiform. Antennæ, with the three last joints forming an oblong triangular mass, externally rounded, internally acuminate. Eyes notched. Thorax conic-cylindric. Metabolia.

Apiarius. *Sp.* 1. *Apiarius.* Blue, hairy. Elytra red, with three transverse black blue bands.

Attelabus apiarius. Linnæus.

Trichodes apiarius. Fabricius.

Clarion apivore. De Geer, Geoff.

Inhabits the nest of bees. Mr Marsham has introduced this into the British *Fauna,* apparently without the least authority.

84. Necrobia. Genus LXXXIV. Necrobia.* Latreille, Olivier.

Dermestes. Linnæus.

Clerus. Geoffroy, De Geer, Marsham.

Corynetes. Paykull, Fabricius.

Palpi terminated with an obconic joint. Antennæ, with the three last joints forming an oblong triangulate mass, obtuse both externally and internally.

Sp. 1. *Ruficollis.* Blue-black; thorax and base of elytra red.

Dermestes ruficollis. Linn.

Corynetes ruficollis. Fabr.

Inhabits Europe.

Tribe X. Silphides.

Antennæ gradually thickening towards their extremities, or terminated by a solid or perfoliated club. Elytra covering the greater portion of the abdomen. Body oval, or parallelopiped.

Family I. *Silphida.*

Palpi very distinct. Mandibles, with their apex entire.

85. Necrophagus. Genus LXXXV. Necrophagus. Fabr. Oliv. Lam.

Silpha. Linn. De Geer, Marsh.

Dermestes. Geoffroy.

Antennæ not much longer than the head, terminated abruptly in a perfoliated knob. Elytra truncated in a strait line, the external margin not canalled or keeled. Body long, quadrate.

Spinipes. *Sp.* 1. *Spinipes.* Black. Antennæ ferruginous at their points. Elytra with their external margin, and a double transverse undulated band of orange. Trochanters of hinder thighs produced into a spine.

Inhabits France and England.

Necrophorus vespillo is readily distinguished from this species, by not having the trochanters produced into a spine.

86. Silpha. Genus LXXXVI. Silpha. Linn. Fabr. De Geer, Oliv. Lam. Latr. Marsh.

Peltis. Geoffroy.

Silpha, Necrodes, Oiceoptoma, Thanatophilus. Leach.

Antennæ a little longer than the thorax. Elytra with an external margin. Body more or less oval. Maxillary palpi terminated by a joint, thinner than the one before it.

* Body elongate, oval. Thorax orbicular. Apex of elytra obliquely truncate. Hinder thighs of the male thicker than the rest.

Genus Necrodes. Wilkin's MSS. Leach.

Obs. Kirby, Spence, Leach, and Wilkin, about the same time, considered this section as constituting a peculiar genus. We have adopted that name proposed by Mr Wilkin, as preferable to any other proposed by the above gentlemen.

Littoralis. *Sp.* 1. *Littoralis.* Black. Antennæ, with the three last joints ferruginous. Elytra with three elevated lines, the two external ones connected by a tubercle. Hinder tibiæ of the male arcuate; thighs of the same sex toothed.

Silpha littoralis. Linn. Fabr. Latr. Oliv. Marsh.

Necrodes littoralis. Leach.

Inhabits dead bodies, especially on the borders of lakes, or on the shores of the sea.

urtisi. *Sp.* 2. *Curtisi.* Black. Antennæ, with the three last joints ferruginous. Elytra with three elevated lines, the two external ones connected by a tubercle. Hinder tibiæ of the male straight; thighs of the same sex not dentate.

Necrodes curtisi. Leach.

Inhabits Britain with the other species, but is more abundant, and is not so large by one half.

** Body oval. Thorax nearly semicircular, transverse, emarginate before. (Elytra of the female entire.†) Antennæ with the club abrupt, distinct.

Genus Oiceoptoma. Leach.

'horacica. *Sp.* 3. *Thoracica.* Black. Thorax unequal, ferruginous, somewhat silky. Each elytron with three elevated lines.

Silpha thoracica. Linn. Fabr. Latr. Marsh.

Inhabits Europe, in dead animals and putrid fungi.

*** Body oval. Thorax nearly semicircular, truncate in front. Antennæ with a gradually formed club.

ibscura. *Sp.* 4. *Obscura.* Black, dull above, finely punctate, shining beneath. Thorax smoothly punctate, the punctures small and close. Each elytron with three elevated straight lines.

Silpha obscura. Linn. Latr. Marsh.

Inhabits Europe. Is very common on path ways in the spring and summer.

7. Agyr-es. Genus LXXXVII. Agyrtes. Frölich, Latreille.

Mycetophagus. Fabricius, Paykull, Panzer.

Antennæ a little longer than the thorax. Palpi maxillary, with the last joint thicker than the preceding joint.

astaneus. *Sp.* 1. *Castaneus.* Shining, smooth, mouth and soles of the feet villose. Head and thorax black, smooth, widely and minutely punctulated. Mouth, antennæ, elytra, and feet, deep castaneous. Scutellum triangular, punctulated at the base, smooth at the apex, sides equal. Elytra striated, the striæ punctated, ten in each. Body beneath brown black, apex of the abdomen paler. Feet villose. Tibiæ with little spines and ciliæ. Length two lines and a quarter.

Agyrtes castaneus. Frölich, Latreille.

Mycetophagus castaneus. Fabricius, Paykull.

Mycetophagus spinipes Panzer.

Inhabits France, Germany, England, and Sweden.

Family II. *Nitidulida.*

Palpi very distinct. Mandibles notched at their extremities.

l. Sca-hidium. Genus LXXXVIII. Scaphidium. Oliv. Payk. Fabr. Latr. Marsh.

Antennæ, with an abrupt club composed of five somewhat hemispheric joints. Body acuminated at each extremity. Elytra truncated. Palpi filiform. Scutellum distinct.

uadrima-latum. *Sp.* 1. *Quadrimaculatum.* Body black, shining. Thorax somewhat coarctate on each side behind. Elytra widely punctured, with two blood red spots on each. Tibiæ striated.

Scaphidium quadrimaculatum. Fabr. Oliv. Paykull, Marsh. Latr.

Inhabits fungi and rotten wood, in Germany, France, and England.

89. Scaphisoma. Genus LXXXIX. Scaphisoma. Leach.

Scaphidium. Fabricius, Latreille, Olivier.

Antennæ, with a club composed of five somewhat oval joints. Body acuminate at each extremity. Elytra truncated. Palpi filiform. Scutellum none.

Obs. The hinder margin of the thorax at the middle produced into an angle.

Agaricinum. *Sp.* 1. *Agaricinum.* Body black, shining, very smooth. Antennæ, apex of the elytra, and feet, pale brown.

Schaphidium agaricinum. Fabr. Latr. Oliv. Panzer.

Scaphisoma agaricina. Leach's MSS.

Inhabits the *Boletus versicolor,* and other fungi.

90. Cholera. Genus XC. Cholera. Latreille, Spence.

Catops. Fabricius, Paykull, Gyllenhall.

Ptomophagus. Illiger.

Mordella. Forster, Marsham.

Helops. Panzer.

Cistela. Olivier, Fabricius.

Luperus. Frölich.

Dermestes. Rossi.

Antennæ straight, with a five-jointed club. Maxillary palpi with the last joint subulate, conic. Labial palpi with last joint obtuse.

Obs. This genus has afforded the subject of a learned and interesting monogragh, by W. Spence, Esq. published by the Linnæan Society in the eleventh volume of their Transactions, to which we refer the reader for descriptions of the species.

Oblonga. *Sp.* 1. *Oblonga.* Narrow, oblong. Thorax narrower behind, the hinder angles obtuse, the middle slightly foveolated. Antennæ somewhat filiform.

Cistela augustata. Fabricius.

Choleva oblonga. Latreille, Spence.

Catopes elongatus. Paykull, Gyllenhall.

Ptomophagus rufescens. Illiger.

Mordella picea. Marsham.

Luperus cisteloides. Frölich,

Inhabits moss, and under stones.

91. Mylæchus. Genus XCI. Mylæchus. Latreille.

Catops. Paykull.

Choleva. Spence.

Antennæ incurved, shorter than the thorax, the basal joints distinctly thicker than the rest; club five-jointed, the joints transverse. Palpi of the maxilla, with the last joint subulate. Labial palpi, with the last joint obtuse.

Brunneus. *Sp.* 1. *Brunneus.* Oblong-ovate, black-brown, finely but widely punctate, slightly pubescent.

Catops brevicornis. Paykull.

Mylæchus Brunneus. Latreille, *Gen. Crust. et Ins.* vol. ii. p. 30. tab. 8. fig. 11.

Choleva brunnea. Spence.

Inhabits France, Sweden, and England, in which latter country it has occurred but twice.

92. Cryptophagus. Genus XCII. Cryptophagus. Herbst, Paykull, Gyllenhall.

Ips. Olivier, Latreille.

Dermestes. Fabricius, Scopoli, Panzer.

Body depressed, back plain. Tarsi with elongate slender joints. Antennæ with a compact three-jointed club.

Cellaris. *Sp.* 1. *Cellaris.* Testaceous ferrugineous, widely punctate, pubescent. Thorax finely denticulated, on each side distinctly unidentate, anterior angles dilated, rounded, ending behind in an obsolete tooth.

Ips cellaris. Olivier, Latreille.

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† The genus Thanatophilus of Leach, which contains *Silpha sinuata* of Fabricius, differs from this division merely in having the apex of the elytra of the female deeply notched; we have therefore not adopted it.

Dermestes cellaris. Scopoli.
Cryptophagus cellaris. Paykull, Gyllenhall.
Cryptophagus crenatus. Herbst.
Dermestes fungorum. Panzer.

Inhabits houses. It varies with black elytra, having the shoulders ferruginous.

93. ENGIS. GENUS XCIII. ENGIS, Paykull, Fabricius, Gyllenhall.
IPS. Herbst.
EROTYLUS. Olivier.
DACNE. Latreille.

Body depressed, back plain. Antennæ with a three-jointed, much perfoliated club. Tarsi with the three first joints short.

Humeralis. *Sp.* 1. *Humeralis.* Elliptic, black, shining, punctate; antennæ, head, thorax, humeral spot on the elytra and feet red, approaching to blood-red.

Engis humeralis. Paykull, Fabricius, Gyllenhall.
Ips humeralis. Herbst.
Dacne humeralis. Latreille.

Inhabits Europe, under the bark of trees and in Boleti. *Nitidula ruffrons* of Marsham is scarcely distinct.

94. CALOBICUS. GENUS XCIV. CALOBICUS. Latreille.
NITIDULA. Rossi.
DERMESTES. Fabricius, Paykull.

Body depressed; back plain. Antennæ with a two-jointed club. Mouth covered as with a hood.

Marginatus. *Sp.* 1. *Marginatus.* Elongate-oval, obscure blackish; antennæ, margins of the head, thorax, and elytra, fuscous-ferruginous; elytra with punctured striæ.

Nitidula hirta. Rossi.
Colobicus marginatus. Latreille.

Inhabits the south of France, under the bark of trees. Length two lines.

95. THYMALUS. GENUS XCV. THYMALUS. Latreille.
PELTIS. Kugellan, Illiger, Paykull, Fabricius.
OSTOMA. Laicharting.

Body depressed; back plain. Tarsi with the third joint neither bifid nor dilated. Palpi terminated by a thick joint. Mandibles prominent. Antennæ with a three-jointed club.

Ferrugineus. *Sp.* 1. *Ferrugineus.* Fuscous-castaneous, with a paler border; thorax with impressed punctures; elytra with six elevated lines on each, three of which are punctulated; the interstices with a double series of excavated punctures.

Peltis ferruginea. Kugellan, Fabricius, Illiger.
Thymalus ferrugineus. Latreille.

Inhabits northern Europe, under the bark of trees.

96. NITIDULA. GENUS XCVI. NITIDULA. Linn. Fabr. Payk. Oliv. Latr.

Mandibles prominent. Body short, depressed; back plain. Thorax generally broad. Antennæ with the third joint twice as long as the second; club abrupt and orbicular, composed of three joints.

Bipustulata. *Sp.* 1. *Bipustulata.* Body elliptic, brown-blackish; thorax emarginate; elytra with a red spot on each.

Nitidula bipustulata. Linn. Latr. Fabr.

Inhabits dead carcasses and Boleti.

97. IPS. GENUS XCVII. IPS. Fabricius, Herbst, Gyllenhall.
NITIDULA. Latreille.

Mandibles prominent, strong, and much bent at their points. Body elongate-quadrate; back plain. Thorax transverse-quadrate. Antennæ with the third joint twice as long as the second; club abrupt and orbicular, composed of three joints.

Ferruginea. Sp. 1. *Ferruginea.* Red-castaneous punctate; the punctures of the elytra running together at the suture; mandibles black at their points.

Ips ferruginea. Fabr. Payk. Panz.
Nitidula linearis. Latreille.

Inhabits Europe.

98. BITYRUS. GENUS XCVIII. BITURUS. Latr.
IPS. Olivier.
DERMESTES. Geoffroy, De Geer, Fabricius.

Antennæ with the third joint not twice as long as the following joint; club composed of three joints. Mandibles prominent. Body oval or oblong; back plain. Thorax broad behind, with the angles pointed. Elytra covering the abdomen.

Tomentosus. *Sp.* 1. *Tomentosus.* Antennæ shorter than the thorax; thorax short, the posterior angles broadly depressed, reflected; body oval, black, with a reddish-yellow down; antennæ and feet yellow-red.

Dermestes tomentosus. Fabr. Illig. Payk.
Dermestes fumatus. Herbst.
Byturus tomentosus. Latreille.

Inhabits Europe, on the flowers of the ranunculus, rose, &c.

99. CATERETES. GENUS XCIX. CATERETES. Herbst, Illiger.
BRACHYPTERUS. Kugellan.
DERMESTES. Linn. Fabr.
STRONGYLUS. Herbst.
NITIDULA. Olivier.

Antennæ with the third and following joint scarcely different in length; club compressed, perfoliate, obconic, composed of three joints. Thorax rounded, without angles behind. Elytra very short. Body depressed back plain. Mandibles prominent.

FAMILY III. *Micropeplida.*

Labial palpi scarcely distinct. Antennæ placed in an excavation of the thorax. Mandibles with their apex arcuate and acute.

100. MICROPEPLUS. GENUS C. MICROPEPLUS.

Antennæ with the club composed of but one joint. Maxillary palpi with the last joint subulate.

Porcatus. *Sp.* 1. *Porcatus.* Black; elytra cancellated.

Staphylinus porcatus. Paykull.

Inhabits sandy ground.

TRIBE XI. STAPHYLINIDES.*

Antennæ gradually thickening towards their extremities, or terminated by a perfoliated mass. Elytra covering about half the abdomen, or less, but very rarely more. Body long, and more or less narrow.

DIVISION I.

Anterior margin of the head (bearing the mandibles) immediately behind the eyes, terminated by a transverse straight line, (or with a line slightly bent in the middle,) not rounded or crooked at their sides. Antennæ inserted below the middle part of the above-mentioned line. Thorax long. Neck distinct. Body very long and narrow. Elytra covering a very small portion of the abdomen.

101. AS- TRAPÆ GENUS CI. ASTRAPÆUS. Gravenherst, Latreille.
STAPHYLINUS. Fabricius, Olivier, Rossi.

Palpi terminated with a joint nearly securiform. Antennæ nearly filiform, distinctly longer than the head,

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* Gravenherst has written an admirable monograph on this tribe, entitled, *Monographia Coleopterorum Micropterorum.* Kirby, the illustrious author of *Monographia Apum Angliæ*, is about to publish a paper on this interesting tribe of insects.

Metabolis. with somewhat globose-conic joints. Lip slightly emarginate.

Ulmi. *Sp.* 1. *Ulmi.* Black, shining; mouth, two basal joints of the antennæ, nearly the whole of the last joint but one of the abdomen, the elytra (the suture excepted,) reddish-brownish; thorax very smooth, with one or two impressions; elytra with four dots arranged longitudinally in their middle.

Astrapæus ulmi. Gravenherst, Latreille.

Staphylinus ulmi. Rossi.

Staphylinus ulmineus. Fabricius.

Inhabits Italy and the south of France under the bark of the elm.

10. Staphylinus. Genus CII. Staphylinus. Linn. Fabr. Latr. Oliv. Lam. Graven.

Palpi filiform. Antennæ towards their extremities distinctly thicker, moniliform, the last joint obliquely truncate or emarginate. Lip deeply emarginate.

Erythropterus. *Sp.* 1. *Erythropterus.* Black; the greater part of the antennæ, elytra, and feet, red; hinder margins of the head and thorax, the breast and a double series of spots on each side of the abdomen, golden yellow tomentose.

Staphylinus erythropterus. Linn. Latr. Fabr.! Grav.

Inhabits Europe in dung.

Politus. *Sp.* 2. *Politus.* Black; head and thorax brassy-black; head ovate, narrower than the thorax, impressed with some distant dots: thorax with six or eight impressed dots, placed in a double longitudinal series; elytra darker, nearly smooth.

Staphylinus politus. Gravenherst, Latreille.

Inhabits dung.

103. Lathrobium. Genus CIII. Lathrobium. Gravenherst, Latreille.

Pæderus. Gravenherst, Fabricius, Olivier.

Staphylinus. Linnæus, Geoffroy.

Palpi subulate, with the last joint acicular and minute. Antennæ nearly filiform, joints nearly conic, those towards the extremities more rounded, and somewhat globose. Lip deeply notched, nearly bilobate.

longatum. *Sp.* 1. *Elongatum.* Pubescent, minutely but widely punctated, black, shining; with the mouth, antennæ, and apex of the elytra and feet, red-brown; head ovate; antennæ about the length of the thorax, with the outermost joints nearly globose; thorax elongate-quadrate, with obtuse angles, the breasts equal, the middle dorsal line smooth.

Lathrobium elongatum. Gravenherst, Latreille.

Staphylinus elongatus. Linnæus.

Pæderus elongatus. Fabricius.

Inhabits putrid vegetables, and under stones.

ficorne. *Sp.* 2. *Ruficorne.* Black-fuscous, pubescent, widely but finely punctate; mouth, antennæ and thorax, red; elytra and feet yellow-red; antennæ moniliform; thorax quadrate; dorsal line smooth.

Pæderus bicolor. Gravenherst, Olivier.

Lathrobium ruficorne. Latreille.

Inhabits France under stones.

DIVISION II.

Anterior margin of the head circumscribed by a curved line, the antennæ inserted on this side of the level of the line. Elytra covering half the abdomen or more. Thorax generally longer than broad, or with equal diameters.

Subdivision 1.

Maxillary palpi longer than the labial one, with their extremities thickest; the last joint obscure. Body linear. Head with a distinct neck. Thorax orbicular or cylindric. Metabolis.

104. Pæderus. Genus CIV. Pæderus. Fabr. Oliv. Latr. Payk. Lam. Graven.

Staphylinus. Linnæus, Geoffroy, De Geer.

Antennæ inserted before the eyes, insensibly thickening towards their extremities; the third joint very long. Eyes moderately large.

Riparius. *Sp.* 1. *Riparius,* Body red, shining; head, antennæ (four basal joints excepted,) apex of the abdomen, and knees, black; elytra blue, with wide impressed dots.

Pæderus riparius. Fabr. Latr. Oliv. Graven.

Staphylinus riparius. Linnæus.

Inhabits banks and beneath stones.

105. Stenus. Genus CV. Stenus. Latr. Cuv. Lam. Fabr. Payk. Grav.

Staphylinus. Linn. Marsh.

Pæderus. Olivier.

Antennæ inserted at the interior margin of the eyes, abruptly thicker at their extremities, the inferior joints cylindric, the outer ones conic-globose. Eyes nearly globose, large.

Biguttatus. *Sp.* 1. *Biguttatus.* Black, with grey down, minutely punctate, somewhat rugulose; vertex of the head with an elevated line; thorax behind with an impressed little line; each elytron with a reddish round spot.

Staphylinus guttatus. Linnæus, Marsham.

Stenus Biguttatus. Fabr. Payk. Grav. Latr.

Inhabits Europe in moist places near water, as on the banks of streams or ponds.

Subdivision 2.

Maxillary palpi not much longer than the labial, not thicker at their extremities; the last joint distinct.

A. Mandibles strong, with their internal edge with one or more teeth. Head free.

a. The second, third, and fourth joints of the tarsi very short; the last joint as long as the others united.

106. Oxyporus. Genus CVI. Oxyporus. Fab. Oliv. Lam. Grav. Latr.

Staphylinus. Linn. Geoff. De Geer.

Antennæ scarcely longer than the head, terminated by a perfoliated mass. Maxillary palpi filiform; the labial ones terminated by a very large lunate joint. Thorax semicircular. Head broader than the thorax.

Rufus. *Sp.* 1. *Rufus.* Red; suture and apex of the elytra, anus and breast, black.

Oxyporus rufus. Fabr. Latr. Grav. Oliv.

Staphylinus rufus. Linn.

Inhabits boleti and other fungi.

107. Oxytelus. Genus CVII. Oxytelus. Grav. Latreille.

Antennæ somewhat broken, incurved, thicker externally, with the last joints foliate above; the extreme joint globose ovate; the basal joint very long conic. Palpi subulate. Anterior tibiæ very spiny, with their extremities notched or narrowed externally, with their tarsi capable of being reflected from their sides.

Carinatus. *Sp.* 1. *Carinatus.* Black, shining, distinctly and widely impresso-punctate, front unequal, somewhat inclined to be rugulose, the anterior space between the eyes rather smooth; thorax impressed on each side; the middle with three grooves and four carinæ; the two middle ones joining together; feet blackish; tibiæ with very short little spines.

Oxytelus carinatus. Gravenherst, Latreille.

Inhabits the dung of men and other mammalia.

108. Omalium. Genus CVIII. Omalium. Gravenherst, Latreille.

Staphylinus. Geoffroy, Fabricius, Olivier.

Palpi filiform. Antennæ thicker towards their extremities, the last joints rounded, somewhat perfoliate. Thorax transverse quadrate, the anterior angles rounded.

Rivulare.

Sp. 1. *Rivulare.* Blackish, punctate; base of the antennæ and feet pale brown; head with two impressions between the eyes; thorax marginated, impressed at the hinder angles, back with two grooves; elytra twice as long as the thorax; obscure brown.

Omalium rivulare. Graven. Latr.

Staphylinus rivularis. Paykull.

Inhabits France and England.

b Tarsi with elongate joints, the last joint shorter than the others united.

109. Anthophagus.

Genus CIX. Anthophagus. Graven.

Staphylinus. Fabr. Paykull, Olivier.

Carabus. Panzer, Marsham.

Antennæ nearly filiform, the second and following joints oboonic. Palpi filiform. Thorax elongate, somewhat cordiform, narrow and truncate behind.

Punctulatus.

Sp. 1. *Punctulatus.* Black fuscous, somewhat smooth, minutely and finely punctate; antennæ and feet obscure rufous.

Carabus dimidiatus. Panzer.

Carabus staphylinoides. Marsham.

Lestiva punctulata. Latreille, *Gen. Crust. et Ins.* i. p. 297, tab. 9. fig. 1.

Inhabits France and England; in the last country it must be considered as of very rare occurrence.

110. Proteinus.

Genus CX. Proteinus. Latreille.

Antennæ evidently thicker towards their extremities. Palpi subulate. Thorax transverse.

Brachypterus.

Sp. 1. *Brachypterus.* Depressed, flat, black, shining, smooth, silky above; mandibles, basal joint of the antennæ, and feet, brown red; head a little narrower than the thorax, triangular; thorax short, smooth, anteriorly a little narrower, the sides somewhat rounded, very slightly margined, the hinder margin twice as broad as long, the angles slightly prominent and somewhat reddish; scutellum very small; elytra elongate quadrate, externally marginate; the hinder and external margins rounded; abdomen with the four last joints naked.

Proteinus brachyterus. Latr.

Inhabits France and England.

B. Mandibles without denticulations on their internal edge. Head inserted into the thorax more or less.

a. Antennæ wide apart, inserted before the eyes the fifth and following joints, longer than broad. Tibiæ spinose.

111. Tachinus.

Genus CXI. Tachinus. Graven. Latr.

Oxyporus. Fabricius.

Staphylinus. Linné, Geoffroy, Olivier, Paykull.

Palpi filiform.

Rufipes.

Sp. 1. *Rufipes.* Black, shining, smooth; antennæ fuscous: elytra and feet generally brown; external apex of the elytra paler.

Staphylinus rufipes. Paykull.

Tachinus rufipes. Grav. Latr.

Oxyporus rufipes. Fabricius?

Inhabits the dung of oxen and horses.

112. Tachyporus.

Genus CXII. Tachyporus. Grav. Latr.

Staphylinus. Linn. Oliv. Geoff. Marsh.

Oxyporus. Fabricius.

Palpi subulate.

Chrysomelinus.

Sp. 1. *Chrysomelinus.* Black, shining, smooth; thorax, elytra (base excepted), and feet, red yellow; thorax somewhat transverse; abdomen with the extremity truncate.

Tachyporus chrysomelinus. Grav. Latr.

Oxyporus chrysomelinus. Fabr.

Staphylinus chrysomelinus. Linn. Marsh.

Inhabits flowers, the roots of grass, and moss.

b. Antennæ more or less approximate, inserted at the anterior internal margin of the eye, fifth and following joints broader than long. Tibiæ not spiny.

113. Ale- chara.

Genus CXIII. Aleochara. Knoch, Graven. Latreille.

Staphylinus. Linn. Fabr. Geoff. De Geer, Oliv. Marsh

Head with the hinder part received into the thorax.

Obs. This genus certainly should be divided into three or more genera.

* Head about as broad as the thorax, somewhat triangular; neck distinct, but not very slender; thorax quadrate, with rounded angles in some; somewhat orbiculate, as broad as the elytra behind in others.

Canaliculata.

Sp. 1. *Canaliculata.* Red fuscous, feet paler; head and the two last joints, save one of the abdomen, black; elytra together transverse quadrate; back of the thorax excavated with an impressed longitudinal line in the middle.

Aleochara canaliculata. Grav. Latr.

Staphylinus canaliculatus. Fabr.

Inhabits sandy banks and under stones.

* * Head globose, behind removed from the thorax with a very distinct slender neck; thorax somewhat globose, or somewhat cordate, rounded before, narrow, truncated behind, and narrower than the elytra.

Impressa.

Sp. 2. *Impressa.* Reddish, head black, thorax with three lines, and with two impressions behind; base of the elytra with two little impressed lines.

Aleochara impressa. Grav. Latr.

Inhabits Agarics and Boleti.

114. Lo- mechusa.

Genus CXIV. Lomechusa. Grav. Latr.

Head disengaged from the thorax behind, with an inconspicuous neck or none. Thorax transverse, the sides rounded. Antennæ distinctly perfoliated.

Bipuncta

Sp. 1. *Bipunctata.* Black, somewhat silky, thorax convex; elytra conjoined transverse quadrate, with a blood red spot in each; feet, hinder margin of the posterior segments of the abdomen, and anus, red brown.

Aleochara bipunctata. Latreille.

Inhabits horse dung.

Obs. In a natural arrangement of the genera, Pselaphus should probably be placed after *Lomechusa*, but in the present infant state of our knowledge, we must keep that genus in the section Dimera.

Tribe XII. Scydmænides.

Body ovoid, rounded at each extremity. Palpi very long. Tarsi short. Elytra hard, covering the abdomen. Antennæ gradually thicker towards their extremities.

115. M- tagus.

Genus CXV. Mastagus. Hoffmansegg, Latreille, Hellwigg.

Ptinus. Fabricius, Olivier.

Antennæ filiform, (or nearly so), composed of long joints, geniculated. Maxillary palpi with the two last joints forming an oval mass.

Palpalis

Sp. 1. *Palpalis.* black.

Inhabits Portugal; was discovered by Count Hoffmansegg. In Dr Leach's possession there are two specimens which were said to have been taken in Britain.

116. Sc- mænus.

Genus CXVI. Scydmænus. Latreille.

Pselaphus. Illiger, Paykull.

Anthicus. Fabricius.

Antennæ gradually thickening towards their extremities. Maxillary palpi terminated by an acicular obscure joint.

Hellwigii. *Sp.* 1. *Hellwigii.* Last joint of the maxillary palpi obsolete; three last joints of the antennæ forming a club. Thorax ovate. Body fuscous-red-brown, pubescent. Head, thorax, and abdomen, darker. Elytra smooth.

Pselaphus hellwigii. Herbst, Paykull, Illiger.

Anthicus hellwigii. Fabr.

Scydmænus hellwigii. Latr.

Inhabits the roots of trees, and under moss.

Godarti. *Sp.* 2. *Godarti.* Last joint of the maxillary palpi conspicuous, dentiform, the joints at the apex of the antennæ not abruptly larger than the preceding ones. Thorax somewhat elongate-quadrate, a little narrower behind. Body deep castaneous, pubescent.

Scydmænus Godarti. Latr. *Gen. Crust. et Ins.* 1. 282. tab. 8. fig. 6.

Inhabits France.

Tribe XIII. Ptinides.

Antennæ much longer than the head, filiform, or terminated by three large joints, not united into a mass.

Division I.

Antennæ uniform, not terminated, with three joints larger than the rest.

117. Ptinus. **Genus CXVII. Ptinus.** Linn. Fabr. Latr. Lam. Oliv.

Bruchus. Geoffroy.

Antennæ approximate, inserted between the eyes. Eyes projecting. Thorax hood-like. Abdomen nearly oval. Elytra united in the male.

Fur. *Sp.* 1. *Fur.* Red-fuscous. Thorax with four tubercles transversely striated, the two middle ones highest, with tufts of hair, contracted and margined behind. Abdomen ovate, rounded at the base. Elytra villose, with two yellow-grey bands. The second joint of the antennæ shorter than the third. Under part of the body with short grey-yellow hairs.

Ptinus Fur. Linn. Fabr. Latr. Oliv.

Inhabits houses, committing horrid devastations in museums.

Ptinus testaceus of Marsham, is merely the male of this species.

Germanus. *Sp.* 2. *Germanus.* Fuscous. Thorax with four tubercles transversely seriated; with short, obscure-red hairs, hinder part contracted and marginated. Abdomen quadrate ovate, base straight, transverse, (not narrower. Elytra blackish, with two bands and a spot at the apex, whitish; the shoulders prominent. Antennæ with the second joint of the same magnitude with the third. Under part of the body with grey hairs. Thighs with a naked or brown band.

Ptinus Germanus. Fabr. Latr.

Ptinus elegans. Illig. Fabr.

Inhabits houses, with the other.

118. Gibbium. **Genus CXVIII. Gibium.** Scopoli, Latr.

Bruchus. Geoff.

Ptinus. Fabr. Oliv.

Scotias. Czenpinski.

Antennæ inserted before the eyes, simple, and setaceous. Eyes not projecting. Thorax not hoodlike. Abdomen nearly globular. Elytra united.

Scotias. *Sp.* 1. *Scotias.* Castaneous, shining, smooth, antennæ and feet pubescent.

Ptinus Scotias. Fabr. Oliv.

Gibbium Scotias. Latr.

Inhabits the museums of southern Europe.

Genus CXIX. Ptilinus. Geoff. Oliv. Lam. Fabr. Latr. 119. Ptilinus.

Anobium. Illiger.

Serrocerus. Kugellan.

Ptinus. Linn. Marsh.

Antennæ inserted before the eyes, very much pectinated in the males, serrated in the females.

Body long ovoid, nearly cylindric. Thorax somewhat globose.

Sp. 1. *Pectinicornis.* Body blackish. Elytra obscure brown. Antennæ and feet reddish. Thorax rough. Elytra punctate. Pectinicornis.

Ptilinus pectinicornis Fabr. Oliv. Latr.

Ptinus pectinicornis. Linn. Marsh.

Dermestes pectinicornis. Linn.?

Inhabits old trees and houses, perforating them to destruction. *Ptinus serraticornis,* Marsham, is the female of this insect.

Genus CXX. Xyletinus. Latr. 120. Xyletinus.

Ptilinus. Illiger.

Antennæ inserted before the eyes, serrated in both sexes. Body short ovoid.

Sp. 1. *Lævis.* Lævis.

Ptilinus lævis. Illiger.

Xyletinus lævis. Latr.

Inhabits Europe.

Division II.

Antennæ terminated by three joints different from the rest in size.

Genus CXXI. Anobium. Fabr. Oliv. Delamark, Latr. 121. Anobium.

Ptinus. Linn. De Geer, Marsham.

Bruchus. Geoff.

Antennæ eleven-jointed, with the three last joints abruptly thicker than the others; the ninth and tenth joints obconic; the tenth oval.

* Thorax short transverse.

Sp. 1. *Tessalatum.* Thorax bilobate behind the lateral margins reflexed. Body fuscous, sprinkled with villose, obscure luteous spots. Elytra not striated. Tessalatum.

Anobium tessalatum. Fabr. Latr.

Ptinus tessalatus. Marsham.

Inhabits Europe.

Sp. 2. *Molle.* Thorax with the lateral margins not marginated, acute. Body rufous-fuscous, smooth. Eyes black. Molle.

Amobium molle. Fabr. Oliv. Latr.

Ptinus mollis. Linn.

Inhabits Europe.

** Thorax not much broader than long.

Sp. 3. *Striatum.* Fuscous, with greyish down. Thorax with a gibbous protuberance, unisulcate above, with the angles compressed. Hinder margins somewhat marginated. Elytra longitudinally punctate. Striatum.

Anobium striatum. Latr. Oliv. Illig.

Anobium pertinax. Fabr. Paykull.

Inhabits Europe.

Genus CXXII. Dorcatoma. Payk. Latr. Fabr. 122. Dorcatoma.

Antennæ nine-jointed; the three last joints very large, the seventh and eighth triangular, and much dilated on their internal side.

Sp. 1. *Dresdense.* Dresdense.

Dorcatoma Dresdense. Fabr. Latr.

Inhabits Europe.

TRIBE XIV. DERMESTIDES.

Antennæ slender, longer than the head, and terminated by a large ovoid mass.

FAMILY I. *Dermistida.*

Sternum not produced to the mouth, or over it like a neckcloth. Tibiæ spinose.

123. Dermestes. GENUS CXXIII. DERMESTES. Linn. Fabr. Latr. Marsh. Herbst, Oliv.

Antennæ with an ovate club, the last joint short, not (or but little) longer than the preceding joint. Body narrow oval. Thorax with the hinder margin straight, or obtusely lobed. Palpi very short; maxillary palpi shorter than the maxillæ, or scarcely as long.

Lardarius. *Sp.* 1. *Lardarius.* Black; base of the elytra with a cinereous-band, with black points.

Dermestes lardarius. Linn. Fabr. Latr. Marsh.

Inhabits Europe.

Dermestes, 2. *Vulpinus,* 3. *Murinus,* 4. *Tesselatus* are the other indigenous species of this genus.

124. Attagenus. GENUS CXXIV. ATTAGENUS. Latr.* Leach.

MEGATOMA. Herbst.

DERMESTES. Fabr. Linn. Latr. Marsh.

Antennæ with an elongate-ovate club, the last joint longer than the preceding, (especially in the male,) triangular or conic. Body broad-oval. Thorax with the posterior margin narrowly and acutely lobed. Maxillary palpi exserted, longer than the maxillæ; the last joint elongate-cylindric, very long in some.

Pellio. *Sp.* 1. *Pellio.* Black; middle of the antennæ and of the tarsi obscure red; hinder margin of the thorax with three spots, and the elytra with a spot on each side of the suture vellose-white; antennæ of the male with the last joint ensiform, very long.

Dermestes pellio. Linn. Fabr. Marsh. Latr.

Megatoma nigra. Herbst. (Variety of the male.)

Inhabits skins in houses, and is found sometimes on flowers.

Trifasciatus. *Sp.* 2. *Trifasciatus.* Black; hinder margin of the thorax, three bands on the elytra, and the breast grey-villose.

Dermestes trifasciatus. Fabr. Latr.

Inhabits Europe; is found in the south of France, in Sweden, and in Scotland.

FAMILY II. *Megatomida.*

Sternum produced over the mouth, like a neckcloth. Tibiæ not or but slightly spined.

125. Megatoma. GENUS CXXV. MEGATOMA.† Herbst, Latr.

DERMESTES. Linn. De Geer, Fabr.

Body narrow-oval. Antennæ with an oval or oblong club, with the internal edge simple.

Undatum. *Sp.* 1. *Undatum.* Black; sides of the thorax and two undulated bands on the elytra, white-villose. Tarsi obscure red.

Megatoma undulata. Herbst.

Megatoma undatum. Latr.

Dermestes undatus. Linn. Fabr. Oliv. Panz.

TRIBE XV. BYRRHIDES.‡

Body ovoid. Feet entirely or semicontractile. Sternum anteriorly produced to the mouth in the form of a neckcloth. Antennæ thicker towards their extremities.

DIVISION I.

Tarsi with five very distinct articulations.

Subdivision 1.

Antennæ straight, not inserted in the cavity of the eyes. Feet perfectly contractile. Mandibles but little, or not at all, prominent.

126. Anthrenus. GENUS CXXVI. ANTHRENUS. Geoff. Fabr. Oliv. Lam. Latr.

BYRRHUS. Linn. Marsham.

DERMESTES. De Geer.

Antennæ shorter than the thorax, with the club solid. Palpi filiform, short. Body orbiculate ovate. Scutellum very minute

Scrophulariæ. *Sp.* 1. *Scrophulariæ.* Black; sides of the thorax, and three transverse bands on the elytra, grey; suture and external margin of the elytra, and hinder margin of the thorax, red-lutescent.

Anthrenus Scrophulariæ. Fabr. Latr.

Byrrhus Scrophulariæ. Linn. Marsh.

Inhabits plants in Europe.

127. Throscus. GENUS CXXVII. THROSCUS. Latr.

ELATER. Linn. Olivier, Geoffroy.

DERMESTES. Fabr. Paykull, Illiger.

Antennæ as long as the thorax, with the three last joints large, forming an oval club. Palpi short, with the last joint securiform. Body elliptic, narrow, depressed,

Obs. This genus probably belongs to the tribe ELATERIDES, from which it differs but in the structure of its antennæ.

Dermestoides. *Sp.* 1. *Dermestoides.* Brown, with grey-yellowish down; elytra, with punctated striæ.

Elater dermestoides. Linn. Oliv.

Dermestes adstrictor. Paykull, Illiger, Fabr.

Thoscus dermestoides. Latr.

Inhabits European plants; is rare in Britain.

128. Byrrhus. GENUS CXXVIII. BYRRHUS. Linn. Fabr. Oliv. Lam. Latr. Illig. Gyll.

CISTELA. Geoffroy, Marsham.

DERMESTES. De Geer.

Antennæ a little shorter than the thorax, with the four or five terminal joints gradually thicker, compressed. Palpi short, the last joint longest, thick, somewhat ovate. Body somewhat ovate, very convex above. Scutellum minute.

Pilula. *Sp.* 1. *Pilula.*

Byrrhus pilula. Linn. Fabr. &c.

Cistela undulata of Marsham is merely a variety of this species.

129. Chelonarium. GENUS CXXIX. CHELONARIUM. Fabr. Latr.

Antennæ seven-jointed, the two last somewhat largest. Palpi with the last joint securiform. Body ovate, more convex below.

Beauvoisi. *Sp.* 1. *Beauvoisi.*

Chelonarium beauvoisi. Latr.

Chelonarium atrum. Fabricius?

Inhabits the Island of St Domingo.

Subdivision 2.

Antennæ elbowed or geniculated, not inserted in the cavity of the eye. Feet perfectly contractile. Mandibles very prominent.

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* DERMESTES of his last work.

† *Megatoma serra* of Latreille, probably constitutes a distinct genus.

‡ An artificial tribe, containing many divisions.

130. Hister. **Genus CXXX. Hister.**[*] Linn. Fabr. &c.

Attelabus. Geoffroy.

Body somewhat quadrate. Thorax transverse. Scutellum small. Elytra shorter than the abdomen. Breast very large. Head intruded into a concavity in the anterior part of the thorax. Palpi filiform, short, unequal, the last joint somewhat cylindric, obtuse.

* Body depressed, the breadth exceeding the height. Tibiæ broad, somewhat triangular. Tarsi short.

a. Body not very much depressed.

Unicolor. *Sp.* 1. *Unicolor.*
Hister unicolor. Linn. Fabr. &c.
Inhabits dung.

b. Body very much depressed.

Planus. *Sp.* 2. *Planus.*
Hister planus. Fabr.
Inhabits beneath the bark of trees.

** Body very thick and high. Tibiæ narrow, elongate. Tarsi slender.

Sulcatus. *Sp.* 3. *Sulcatus.*
Hister sulcatus. Rossi, Latr.
Hister striatus. Fabr. Herbst.
Inhabits the dung of oxen and horses.

Subdivision 3.

Antennæ strait, not inserted in the cavity of the eyes. Feet semicontractile.

131. Nosodendron. **Genus CXXXI. Nosodendron.** Latreille.

Byrrhus. Olivier.

Sphæridium. Fabr. Panzer.

Antennæ terminated abruptly by a three-jointed perfoliated club, composed of three joints.

Fasciculare. *Sp.* 1. *Fasciculare.* Black, shining, distantly punctured; thorax linear, transverse; elytra with elevated, hairy, brownish smoke-coloured dots.
Sphæridium fasciculare. Fabr.
Byrrhus fascicularis. Olivier.
Nosodendron fasciculare. Latr.
Inhabits France and Germany, under the bark of elms.

132. Limnius. **Genus CXXXII. Limnius.** Müller, Gyllenhall, Megerlei.

Dytiscus. Panzer.

Chrysomela. Marsham.

Elmis. Latr.

Antennæ nearly filiform, the last joint largest, somewhat oval.

Volckmari. *Sp.* 1. *Volckmari.*
Dytiscus Volckmari. Panzer, *Faun. Ins. Germ.* fas. 7. fig. 4.
Limnius Volckmari. Müller.
Elmis Volckmari. Latr.
Chrysomela buprestoides. Marsh.

Subdivision 4.

Antennæ inserted in the anterior canthus of the eye.

33. Parnus. **Genus CXXXIII. Parnus.** Fabr. Illiger, Marsh.

Dermestes. Geoffroy.

Elater. Rossi.

Dryops. Olivier, Lamarck, Latr.

riculatus. *Sp.* 1. *Auriculatus.*
Dryops Auriculatus. Latr. Olivier.

Division II.

Tarsi with four distinct joints.

134. Heterocerus. **Genus CXXXIV. Heterocerus.** Bosc, Fabr. Illig. Latr. Marsham.

Antennæ composed of eleven joints, the seven last forming a dentate or serrated mass.

Marginatus. *Sp.* 1. *Marginatus.* Blackish, villose; sides of the thorax and abdomen, with spots on the elytra, margins of the abdomen, and feet, pale luteous.
Heterocerus marginatus. Fabr. Bosc, Illiger, Panzer, Marsham.
Inhabits marshy places, burrowing in the muddy banks of ponds.

135. Georissus. **Genus CXXXV. Georissus.**[†] Latr.

Pimelia. Paykull, Fabr.

Antennæ nine-jointed, the three last joints forming a rounded nearly solid mass.

Pygmæa. *Sp.* 1. *Pygmæa.*
Pimelia pygmæa. Paykull, Fabr.
Georissus pygmæus. Latr.

Tribe XVI. Hydrophilides.

Antennæ terminated by a club. Maxillary palpi very long. Chin or mentum large, clypeiform. Head with the front rounded, cowl-shaped. Feet formed for swimming. Tarsi with the first joint shorter than the second.

Family I. *Helopherida.*

Mandibles without teeth at their extremities. Maxillary palpi generally much shorter than the antennæ. Body oblong. Thorax somewhat quadrate, or nearly semi-orbiculate, or somewhat cordate-truncate. Tibiæ slightly shines. Tarsi filiform, not ciliated, with two strong, acute, entire nails.

136. Helophorus. **Genus CXXXVI. Helophorus.** Leach.

Elophorus. Illiger, Fabr. Latr. Olivier.

Hydrophilus. De Geer, Marsham.

Clypeus entire. Palpi with the last joint oval, thick; maxillary palpi much shorter than the antennæ.

* Body elliptic, or somewhat ovate. Thorax broader than long.

Aquaticus. *Sp.* 1. *Aquaticus.*
Elophorus grandis. Illiger.
Elophorus aquaticus. Fabr. Olivier, Latr.
Inhabits ditches and stagnant pools of water.

** Body nearly linear; thorax elongate-quadrate.

Elongatus. *Sp.* 2. *Elongatus.*
Elophorus elongatus. Fabr. Latr.
Inhabits stagnant waters in England, France and Germany.

137. Ochthebius. **Genus CXXXVII. Ochthebius.** Leach.

Hydræna. Latr. Illiger.

Hydrophilus. Marsham.

Elophorus. Paykull.

Clypeus entire. Palpi with the last joint slender, acuminate; maxillary ones shorter than the antennæ.

Riparia. *Sp.* 1. *Riparia.*
Hydræna riparia. Illiger, Latr.
Elopherus prygmæus. Paykull.
Elopherus minimus. Fabr.
Hydrophilus impressus. Marsham.
Inhabits the waters of Europe.

Marinus. *Sp.* 2. *Marinus.*

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[*] This genus seems to constitute a peculiar family, and might be divided into some very natural genera.

[†] This singular genus has the lip and maxillæ of *Helophorus*; the general habit of *Byrrhus*; and the tarsi of *Heterocerus.*

Subdivison 1.

Labrum prominent even beyond the clypeus. Maxillæ interiorly armed with a horny hook, simple or bifid. Body nearly globular or ovoid. Elytra tumid, embracing the sides of the abdomen.

155. Ægialia. GENUS CLV. ÆGIALIA. Latreille.

APHODIUS. Panzer, Illiger.

PSAMMODIUS. Gyllenhall.

Antennæ distinctly longer than the head; composed of nine joints, the first of which is cylindric and a little hairy. Body nearly globular. Maxillæ with a bifid hook.

Globosa. *Sp.* 1. *Globosa.* Black, shining; head granulated; elytra striated, impunctate.

Aphodius globosus. Illiger.

Psammodius globosus. Gyllenhall.

Ægialia globosa. Latreille.

Inhabits the sandy shores of the sea.

156. Trox. GENUS CLVI. TROX. Fabricius, Olivier, Lamarck, Latreille.

SCARABÆUS. Linn. Marsham, Geoffroy, De Geer.

Antennæ scarcely longer than the head; composed of ten joints, the first obconic and very hairy. Body ovoid. Maxillæ with a simple hook.

Sabulosus. *Sp.* 1. *Sabulosus.*

Trox sabulosus. Fabricius, Latreille.

Scarabæus sabulosus. Linn.

Inhabits sandy places.

Subdivision 2.

Labrum not projecting beyond the clypeus. Body not globose. Elytra not embracing the sides of the abdomen.

a. Labrum entirely hidden. Clypeus triangular. Maxillæ coriaceous, or horny; conic, or triangular. Mouth very hairy. Scutellum very small. (Colours dark.)

157. Sinodendron. GENUS CLVII. SINODENDRON. Fabr. Latr. Don.

SCARABÆUS. Linn. De Geer, Olivier.

LUCANUS. Marsham.

Antennæ with the laminated club not capable of being folded; the lamellæ very short, resembling the teeth of a saw. Body cylindric. Maxillæ coriaceous, bilobate.

Cylindricum. *Sp.* 1. *Cylindricum.* Black, shining, impressed-punctate, cicatriculose; the punctures umbilicated, the umbilici perforate. (Male with a conic-compressed horn; the female with a short horn on the head.)

Sinodendron cylindricum. Fabr. Latr. Donovan.

Scarabæus cylindricus. Linn. De Geer, Olivier.

Lucanus cylindricus. Marsham.

Inhabits old trees, especially the ash. Is very abundant near Cheltenham, and near Plymouth, in decaying ash trees.

158. Oryctes. GENUS CLVIII. ORYCTES. Illiger, Latreille.

SCARABÆUS. Linn. Geoffroy, De Geer, Olivier.

GEOTRUPES. Fabricius.

Antennæ with the lamellæ of the club long and platatile. Body ovoid, convex. Mandibles with their external edge without teeth or folds. Maxillæ coriaceous, one-lobed. Thorax with the sides dilated, and a little rounded.

Nasicornis. *Sp.* 1. *Nasicornis.* Fuscous-castaneous, shining; head with one horn; elytra polished finely, and distantly punctured.

Oryctes nasicornis. Illiger, Latreille.

Scarabæus nasicornis. Linn.

Geotrupes nasicornis. Fabr.

Inhabits Europe in old wood.

159. Phileurus. GENUS CLIX. PHILEURUS. Latr.

SCARABÆUS. Linn. Olivier.

GEOTRUPES. Fabr.

Antennæ with the lamellæ of the club long and plicatile. Body ovoid, depressed. Mandibles with their external edge without teeth or folds. Maxillæ corneous, dentated. Thorax with its sides dilated and rounded.

Dydimus. *Sp.* 1. *Dydimus.*

Geotrupes dydimus. Fabr.

Phileurus dydimus. Latr.

160. Geotrupes. GENUS CLX. GEOTRUPES. Fabr.

SCARABÆUS. Linn. Oliv. Latr. Lam.

Antennæ with the club composed of long, plicatile lamellæ. Body ovoid, convex. Mandibles with their external edge crenulated or toothed. Maxillæ corneous, dentated.

Punctatu *Sp.* 1. *Punctatus.*

Geotrupes punctatus. Fabr.

Scarabæus punctatus. Latr.

Inhabits southern Europe.

b. Labrum with the anterior edge apparent. Clypeus quadrate. Scutellum large. (Colours various and gay.)

* External edge of the mandibles prominent, depressed, with the sides cutting, crenulated, or sinuated. (Body short, ovoid, or somewhat orbicular: Scutellum generally large: Thorax short, broad: Sternum produced into a point anteriorly.)

161. Hexodon. GENUS CLXI. HEXODON. Oliv. Fabr. Lam. Lat.

Mandibles with their points strongly three-toothed. Body nearly orbicular. Elytra with their exterior side dilated and channelled. Antennæ ten-jointed, with a small oval club composed of three lamellæ. Feet slender. Tarsi with very small nails.

Reticulatum. *Sp.* 1. *Reticulatum.*

Hexodon reticulatum. Latr.

Inhabits Madagascar.

162. Rutela. GENUS CLXII. RUTELA. Latr.

SCARABÆUS. Linn. De Geer.

CETONIA. Fabr.

MELOLONTHA. Fabr.

Body more or less ovoid. Elytra with their exterior side not dilated or channelled. Antennæ with their club large and oblong, composed of three lamellæ. Mandibles with their points having three little teeth. Feet strong. Tarsi with strong nails.

* Tarsi with undivided nails; the nails of unequal size.

Punctat *Sp.* 1. *Punctata.*

Melolontha punctata. Fabr.

Rutela punctata. Latr.

Inhabits America.

* * Tarsi with undivided, equal-sized nails.

Lineola. *Sp.* 2. *Lineola.*

Cetonia lineola. Fabr.

Rutela lineola. Latr.

Inhabits America.

* * * Tarsi with one nail divided, and another bifid. (Scutellum very large.)

Chrysis *Sp.* 3. *Chrysis.*

Cetonia chrysis. Fabr.

Rutela chrysis. Latr.

Inhabits America.

* * Mandibles not, or but little, prominent, without any crenatures or sinuosities remarkable in their outer edge. (Body ovoid-oblong: Scutellum small or moderately sized.)

63. Melo-
ntha.

Genus CLXIII. Melolontha. Fabricius, Olivier, Lamarck, Latreille.

Scarabæus. De Geer, Linn. Marsham.

Elytra with their external edge not sinuated, very slightly narrower at their base than at their points. Tibiæ armed with very distinct heels.

ulgaris.

Sp. 1. *Vulgaris.* (Common cockchaffer.)
Melolontha vulgaris. Latreille, Fabricius.
Scarabæus melolontha. Linn.

lstitialis.

Sp. 2. *Solstitialis.* (Summer cockchaffer.)
Melolontha solstitialis. Fabricius, Latreille.
Scarabæus solstitialis. Linn.

tis.

Sp. 3. *Vitis.*
Melolontha vitis. Fabricius, Latreille.

rticola.

Sp. 4. *Horticola.* (Fernweb.)
Melolontha horticola. Fabricius.
Scarabæus horticola. Linn. Marsham.

ricola.

Sp. 5. *Agricola.*
Melolontha agricola. Fabricius.

Obs. The genus *Melolontha* should be divided into a vast number of genera, of which the species are the types of those inhabiting Great Britain.

4. Hop-
ia.

Genus CLXIV. Hoplia. Illiger, Latreille.

Scarabæus. Linn. Geoff. De Geer.

Melolontha. Fabricius, Olivier.

Elytra with their external edge sinuated. Tibiæ with very obscure spurs or heels.

lveru-
nta.

Sp. 1. *Pulverulenta.*
Melolontha pulverulenta. Fabricius.
Inhabits France, England, and Germany.

Division II.

Thorax as long as broad, nearly orbicular, or almost ovoid and truncate at the two extremities. Mandibles partly membranaceous, sometimes entirely corneous. Maxillæ terminated by a membranaceous, or coriaceous lobe.

Subdivision 1.

Labrum prominent. Mandibles entirely corneous. Elytra dehiscent at the extremity of the suture. Abdomen elongate-quadrate.

5. Gla-
yrus.

Genus CLXV. Glaphyrus. Latreille.

Scarabæus. Linn.

Melontha. Fabr. Oliv.

Antennæ terminated by a rounded knob, the two last joints received by the ninth joint.

urus.

Sp. 1. *Maurus.*
Scarabæus maurus. Linn.
Melolontha cardui. Fabr.
Melolontha maurus. Oliv.
Glaphyrus maurus. Latr.
Inhabits Barbary.

. Am-
coma.

Genus CLXVI. Amphicoma. Latr.

Scarabæus. De Geer, Pallas.

Melolontha. Fabr. Oliv.

Antennæ with an ovoid club, having all the lamellæ disengaged.

lis.

Sp. 1. *Melis.*
Melolontha melis. Fabr.
Amphicoma melis. Latr.
Inhabits Barbary.

Subdivision 2.

Labrum not prominent. Mandibles entirely or partly membranaceous.

. Ani-
x.

Genus CLXVII. Anisonyx. Latr.

Scarabæus. Linn.

Melolontha. Fabr. Oliv.

Antennæ with the first joint not very large. Clypeus porrect, a little narrower in front. Palpi very slender, long, terminated by a cylindric joint. Tarsi with unequal nails. Hinder feet large.

Crinitum.

Sp. 1. *Crinitum.*
Scarabæus longipes. Linn.
Melolontha crinita. Fabr.
Anisonyx crinitum. Latr.
Inhabits the Cape of Good Hope.

168. Tri-
chius.

Genus CLXVIII. Trichius. Fabr. Latr.

Scarabæus. Linn. Geoff. De Geer, Marsham.

Cetonia. Olivier.

Antennæ with the first joint very large. Clypeus quadrate. Palpi short, with their last joints oval. Tarsi with equal nails.

* Body almost entirely (above at least) smooth. Hinder feet, with the tibiæ and tarsi, of almost equal lengths.

Nobilis.

Sp. 1. *Nobilis.*
Trichius nobilis. Fabr. Latr.
Cetonia nobilis. Oliv.
Scarabæus nobilis. Linnæus, Marsham.

** Body tomentose. Hinder feet, with the tarsi most distinctly longer than the tibiæ.

Fasciatus.

Sp. 2. *Fasciatus.*
Trichius fasciatus. Latreille, Fabr.
Cetonia fasciata. Olivier.
Scarabæus fasciatus. Linnæus.
Inhabits Europe on umbelliferous flowers.

169. Cre-
mastochei-
lus.

Genus CLXIX. Cremastocheilus. Knoch, Latreille.

Antennæ with the first joint very large. Clypeus transverse, the anterior margin replected, arcuate, entire. Palpi short, with the last joint very long, cylindric, the apex obtuse. Thorax with the anterior angles dilated, tuberculiform. Tarsi with equal nails.

Castaneus.

Sp. 1. *Castaneus.*
Cremastocheilus castaneus. Latreille, Knoch.
Inhabits America.

Family II. *Cetonida.*

A triangular scale interposed between the posterior angles of the thorax, and the exterior of the base of the elytra.

170. Golia-
thus.

Genus CLXX. Goliathus.

Goliath. Latreille.

Cetonia. Fabr. Oliv.

Maxillæ corneous, or very hard. Mentum very large. Thorax orbicular. Elytra slightly or not at all situated at their external edge. Clypeus with two diverging lobes.

Polyphe-
mus.

Sp. 1. *Polyphemus.*
Cetonia polyphemus. Fabr.
Goliath polyphemus. Latr.

171. Ceto-
nia.

Genus CLXXI. Cetonia. Fabr. Latr. Oliv. Lamarck.

Scarabæus. Linn. Geoff. De Geer, Marsh.

Maxillæ almost membranaceous, or coriaceous. Mentum moderately sized. Thorax triangular, with the anterior point truncate. Elytra abruptly sinuated at their external side, towards the base.

Aurata.

Sp. 1. *Aurata.*
Scarabæus auratus. Linn. Marsh.
Cetonia aurata. Fabr. Latr.
Inhabits the flowers of roses.

Tribe XXI. Lucanides.

Antennæ with a pectinated club. Anterior tibiæ large and dentated. Palpi four. Labrum generally

Metabolia. wanting. Mandibles very strong, corneous, dentated, exserted. Mentum corneous.

Family I. *Lucanida.*

Antennæ geniculated. Labrum not discoverable.

* Body ovoid, elevated, convex.

172. Lamprima. Genus CLXXII. Lamprima. Latreille.

Lethrus. Fabricius.

Lucanus. Schreibers, Donovan.

Thorax and elytra marginated. Antennæ with the first joint straight. Mandibles very large. Sternum produced into a horn. Anterior tibiæ with but few teeth (four or five); and a scale of a triangular slope at the apex attached to the heel.

Ænea. *Sp.* 1. *Ænea.* Golden green, smooth.

Lethrus æneus. Fabricius.

Lucanus æneus. Schreibers.

Lamprima ænea. Latreille.

173. Æsalus. Genus CLXXIII. Æsalus. Fabricius, Latreille.

Lucanus. Panzer.

Thorax and elytra not bordered. Antennæ with the first joint bent. Mandibles moderately sized. Sternum simple. Anterior tibiæ with many teeth.

Scarabæoides. *Sp.* 1. *Scarabæoides.*

Æsalus scarabæoides. Latreille, Fabricius.

Lucanus scarabæoides. Panzer.

Inhabits Germany, Austria.

* * Body parallelopiped, depressed.

174. Platycerus. Genus CLXXIV. Platycerus. Geoffroy, Latreille.

Lucanus. Linn. De Geer, Fabricius, Olivier.

Palpi short. Lip smooth.

Caraboides. *Sp.* 1. *Caraboides.*

Lucanus caraboides. Fabricius.

Inhabits rotten trees.

175. Lucanus. Genus CLXXV. Lucanus of authors.

Platycerus. Geoffroy.

Palpi long. Lip bifid, very hairy, the laciniæ resembling pencils.

Cervus. *Sp.* 1. *Cervus.* (Common stag beetle.)

Lucanus cervus. Linn. Fabr. Latr.

Inhabits Europe. *Lucanus inermis* of Marsham is merely the female of this species.

Family II. *Passalida.*

Antennæ not geniculated, simply bent, very hairy. Labrum prominent, and very distinct.

176. Passalus. Genus CLXXVI. Passalus. Fabr. Lam.

Lucanus. Linn. De Geer, Olivier.

Maxillæ corneous, very much toothed. Lip crustaceous. Abdomen separated from the thorax by a wide space. Elytra embracing the sides of the abdomen. Feet short.

Interruptus. *Sp.* 1. *Interruptus.*

Passalus interruptus. Fabr. Latr.

Lucanus interruptus. Linn. Oliv.

Inhabits America.

Sect. II. Heteromera.

Four anterior tarsi five-jointed, hinder pair four-jointed.

Observations. Antennæ eleven-jointed,* never lamellated or furnished with a pectinated head. Labrum in all distinct. Palpi four. Mandibles always horny or corneous, their internal edge armed with one or two teeth. Maxillæ crustaceous at the base, often with two laciniæ, the external one largest, trigonate, or somewhat ovate. Mentum crustaceous, distinct from the lip. Lip coriaceous, hairy. Metabolia.

Division I.

Wings generally wanting. Antennæ inserted under the prominent margin of the head, partly or entirely moniliform. Elytra generally united, embracing the sides of the abdomen. Maxillæ unguiculated on their internal edge. Mentum large, transverse.

Tribe I. Pimeliades.

Family 1. *Pimeliada.*

Mentum large, more or less cordiform.

Division I.

Antennæ abruptly terminated by a globose head. Anterior tibiæ palmated or dentated externally.

Genus CLXXVII. Chiroscelis. Lamarck, Latr. 177. Chiroscelis.

Body parallelopiped, depressed, marginated. Scutellum distinct.

Sp. 1. *Bifenestra.* Bifenestra.

Chiroscelis bifenestra. Latreille, Lamarck.

Inhabits New Holland.

Genus CLXXVIII. Erodius. Fabricius, Olivier, Lamarck. 178. Erodius.

Tenebrio. Linn.

Body nearly orbicular, gibbous. Scutellum none.

Sp. 1. *Gibbus.* Gibbus.

Erodius gibbus. Fabricius, Latreille.

Inhabits southern Europe.

Division II.

Antennæ not terminated by a club. Anterior tibiæ simple.

Subdivision 1.

Body nearly orbicular.

Genus CLXXIX. Zophosis. Latreille. 179. Zophosis.

Erodius. Fabricius, Olivier.

Scutellum none.

Sp. 1. *Testudinaria.* Testudinaria.

Erodius testudinarius. Fabricius.

Zophosis testudinarius. Latreille.

Subdivision 2.

Body oblong. Thorax convex, nearly semilunar, or almost orbicular. Elytra convex.

Genus CLXXX. Pimelia. Fabricius, Olivier, Lamarck, Latreille. 180. Pi lia.

Tenebrio. Linn. Geoffroy.

Thorax much narrower than the abdomen, transverse. Abdomen nearly orbicular.

Sp. 1. *Bipunctata.* Bipuncta

Pimelia bipunctata. Fabricius.

Inhabits southern Europe.

Genus CLXXXI. Moluris. Latreille. 181. Moluris.

Tenebrio. De Geer.

Pimelia. Fabricius, Olivier.

Thorax narrower than the abdomen, almost orbicular. Abdomen oval. Antennæ gradually enlarging externally, the last joint almost ovoid.

Sp. 1. *Striata.* Striata.

Pimelia striata. Fabricius.

Moluris striata. Latreille.

Inhabits Africa.

Genus CLXXXII. Tentyria. Latreille. 182. T tyria.

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* In one œdemera they exhibit the appearance of twelve true joints; many species have the semblance of a twelfth articulation.

Akis. Fabricius.
Pimelia. Olivier.

Thorax almost orbicular, narrower than the abdomen. Abdomen oval. Antennæ filiform, terminated by two or three nearly globose joints.

Interrupta. *Sp.* 1. *Interrupta.*
Tentyria interrupta. Latreille.
Pimelia glabra. Olivier.
Inhabits the western parts of France.

Subdivision 3.

Body oblong. Thorax flat above, more or less truncate-cordate. Elytra plain, or but little convex. Antennæ with the third joint very long.

183. Akis. Genus CLXXXIII. Akis. Herbst, Fabricius.
Tenebrio. Linn.
Pimelia. Olivier.

Elytra united. Thorax with equal diameters, truncate behind. Abdomen oval, the external basal angles rounded. Scutellum very small but distinct.

Reflexa. *Sp.* 1. *Reflexa.*
Akis reflexa. Fabr. Herbst, Latr.
Pimelia reflexa. Olivier.
Inhabits Africa and southern Europe.

184. Eurychora. Genus CLXXXIV. Eurychora. Herbst, Fabricius, Latreille.
Pimelia. Olivier.

Thorax wider behind, transverse, emarginate before; lateral margins elevated. Abdomen triangular, the base truncated. Scutellum none. Elytra united.

Ciliata. *Sp.* 1. *Ciliata.*
Eurychora ciliata. Latreille, Fabricius, Herbst.
Pimelia ciliata. Herbst.

Subdivision 4.

Body oblong. Thorax flat above, more or less quadrate.

185. Asida. Genus CLXXXV. Asida. Latreille.
Machla. Herbst.
Tenebrio. Geoffroy.
Opatrum. Fabr. Oliv.
Pimelia. Panzer.

Thorax with the sides arched, reflexed, anterior margin concave. Antennæ thicker towards their extremities.

Grisea. *Sp.* 1. *Grisea.*
Opatrum griseum. Fabricius.
Machla rugosa. Herbst.
Pimelia variolosa. Panzer.
Asida grisea. Latreille.
Inhabits France, Germany, and Italy.

86. Heget-er. Genus CLXXXVI. Hegeter. Latreille.
Blaps. Olivier.

Thorax quadrate, the sides straight, not reflexed. Antennæ filiform.

triatus. *Sp.* 1. *Striatus.*
Blaps elongatus. Olivier.
Hegeter striatus. Latreille.
Inhabits Teneriffe.

Family II. *Blapsidæ.*

Mentum small, or moderately large, quadrate or orbicular.

Division I.

Palpi filiform.

87. Tege-ia. Genus CLXXXVII. Tegenia. Latreille.
Stenosis. Herbst.
Akis. Fabricius.

Body elongate, depressed. Thorax nearly cylindric. Antennæ somewhat perfoliated. Scutellum very small, conspicuous.

Filiformis. *Sp.* 1. *Filiformis.*
Stenosis angustata. Herbst.
Rhinomacer brentoides. Rossi.
Akis filiformis. Fabricius.
Tegenia filiformis. Latreille.
Inhabits Africa and the south of France.

188. Scaurus. Genus CLXXXVIII. Scaurus. Fabricius, Olivier, Latreille.
Pimelia. Rossi.

Thorax almost quadrate. Abdomen oval, with the base truncate. Antennæ with the third joint slender, nearly cylindric; the eighth, ninth, and tenth, nearly globose; the eleventh conic. Anterior feet thick. Scutellum very small.

Striatus. *Sp.* 1. *Striatus.*
Pimelia carinata. Rossi.
Scaurus striatus. Latreille, Fabricius, Olivier.
Inhabits the south of France.

189. Sepidium. Genus CLXXXIX. Sepidium. Fabricius, Olivier, Herbst, Latreille.

Thorax truncated before and behind, the sides prominent. Scutellum indistinct. Abdomen oval; the base and apex truncated. Antennæ with the third joint long, the tenth obconic, and the eleventh short ovoid. Body elongate ovate.

Tricuspidatum. *Sp.* 1. *Tricuspidatum.*
Sepidium tricuspidatum. Olivier, Latreille, Herbst, Fabricius.
Inhabits Africa and southern Europe.

Division II.

Palpi terminated by a thick joint; the last joint of the maxillary ones securiform.

190. Misolampus. Genus CXC. Misolampus. Latreille.
Pimelia. Herbst.

Body convex. Thorax almost globose. Antennæ with the third and fourth joints of equal length. Scutellum very minute.

Hoffmanseggii. *Sp.* 1. *Hoffmanseggii.*
Pimelia gibbula. Herbst.
Misolampus Hoffmanseggii. Latr. *Gen. Crust. et Ins.* tab. 10. fig. 8.
Inhabits Portugal. Discovered by Count Hoffmansegg.

191. Blaps. Genus CXCI. Blaps. Fabricius, Olivier, Lamarck, Marsham, Latreille.
Tenebrio. Linn. Geoffroy.

Back flat. Thorax almost quadrate. Antennæ with the third joint much longer than the fourth. Elytra with their extremities pointed.

Mortisaga. *Sp.* 1. *Mortisaga.*
Blaps mortisaga. Fabricius, Marsham, Latreille.
Tenebrio mortisagus? Linn.
Inhabits cellars and churches.

Division II.

Wings occasionally wanting. Antennæ partly or entirely moniliform; inserted under the margin of the head. Elytra sometimes united, (in all) embracing the abdomen. Mentum small, not broader than long.

Subdivision 1.

Antennæ generally serrated or pectinated. Head not produced into a rostrum bearing antennæ. Maxillary palpi terminated by a large obtrigonate joint. Tarsi

Metabolia. with the last joint but one bilobate. Nails simple, entire, or bifid.

Tribe II. Tenebrionides.

Mandibles bifid at their extremities. Head more or less triangular, without a contraction behind, at its junction with the thorax.

Family I. *Tenebrionida.*

Tarsi with entire joints. Antennæ moniliform, not perfoliated or serrated. Maxillæ unguiculated.

192. Pedinus. Genus CXCII. Pedinus. Latr.
Tenebrio. Linn. Geof. Marsh.
Blaps. Fabr. Herbst.
Helops. Olivier.
Opatrum. Illiger.

Body oval. Maxillary palpi terminated by a thick joint. Antennæ filiform; the last joints globose or turbinated.

Femoralis. *Sp.* 1. *Femoralis.*
Pedinus femoralis. Latr.
Male.—*Blaps femoralis.* Fabr. Herbst.
Opatrum femoratum. Illig. *Coleop. Bor.* i. 109.
Female.—*Tenebrio femoralis.* Linn.
Opatrum femorale. Illig. *Coleop. Bor.* i. 110.
Blaps laticollis. Herbst.
Inhabits Europe in sandy places.

193. Opatrum. Genus CXCIII. Opatrum. Fabr. Oliv. Lam.
Silpha. Linn.
Tenebrio. Geoff.

Body oval; Maxillary palpi, with their last joint obtrigonate; antennæ gradually thicker towards their extremities; the last joints transverse, compressed.

Sabulosum. *Sp.* 1. *Sabulosum.*
Opatrum sabulosum. Fabr. Latr.
Silpha sabulosa. Linn.
Inhabits Europe in sandy places.

194. Tenebrio. Genus CXCIV. Tenebrio.* Linn. Geoff. De Geer, Fabr. Latr.

Thorax behind as broad as the elytra, or scarcely narrower. Body elongate. Antennæ scarcely gradually thicker towards their extremities, the eighth, ninth, and tenth joints transverse; the last subglobose. Mentum somewhat quadrate. Maxillary palpi with their last joint thick.

Obscurus. *Sp.* 1. *Obscurus.*
Tenebrio obscurus. Fabr. Latr. Panzer.
Inhabits Europe.

Molitor. *Sp.* 2. *Molitor.* (Meal beetle.)
Tenebrio molitor. Linn. Fabr. Latr.
Inhabits houses; the larvæ in meal and flour; it is called *meal worm.*

195. Upis. Genus CXCV. Upis. Fabr. Paykull.
Tenebrio. Latr.
Atelabus. Linn.

Thorax behind narrower than the elytra. Body elongate. Antennæ thicker towards their extremities. Mentum ovate-quadrate; the upper margin rounded. Maxillary palpi with their last joint thick.

Ceramboides. *Sp.* 1. *Ceramboides.*
Attelabus ceramboides. Linn.
Upis ceramboides. Fabr. Payk.
Tenebrio ceramboides. Latr.
Inhabits Sweden, in the *Boletus fomentarius.*

Family 2. *Diaperida.* †

Tarsi with entire joints. Antennæ not moniliform, their extremities perfoliated or serrated.

Division I.

Body linear, or nearly so. Thorax almost quadrate. Antennæ terminated by a club. Maxillæ unguiculated.

Genus CXCVI. Toxicum. Latr. 196. T
Antennæ terminated by an oval compressed club, composed of four joints. cum.

Sp. 1. *Richesianum.* Riches-
Toxicum Richesianum. Latr. *Gen. Crust. et Ins.* 2. Tab. 9. fig. 9. num.
Inhabits the East Indies.

Genus CXCVII. Sarrotrium. Illig. Fabr. 197. S
Hispa. Linn. Marsh. rotrum.
Tenebrio. De Geer.
Orthocerus. Latr.

Antennæ with the last six joints forming a thick, fusiform, downy mass.

Sp. 1. *Muticum.* Mutic
Sarrotrium muticum. Payk. Fabr.
Hispa mutica. Linn. Marsh.
Orthocerus hirticornis. Latr.

Inhabits sandy places. In Britain it is rare, or at least very local. It has been found in gravel pits near Norwich, by Mr Joseph Hooker; in a similar situation near Hampstead, by Mr Stephens; and in the sandy shores near Swansea, in South Wales, it is very abundant in the months of June and July.

Division II.

Body linear. Thorax longer than broad. Antennæ not moniliform, gradually thickening from the third joint; the extremity more or less perfoliated. Maxillæ simple, not unguiculated.

Genus CXCVIII. Hypophlæus. Fabr. Latr. 198. Hy-
Ips. Rossi, Olivier. pophlæ

Antennæ from the fifth joint perfoliated. Labrum exserted. Mentum short, almost transverse-linear. Thorax elongate-quadrate, marginated.

Sp. 1. *Bicolor.* Bicolor.
Hypophæus bicolor. Fabr. Latr.
Ips bicolor. Olivier.
Inhabits under the bark of the elm.

Division III.

Antennæ not moniliform. Body oval, or nearly orbicular; a little longer than broad.

Subdivision 1.

Antennæ not serrated at their extremities.

Genus CXCIX. Phaleria. Latr. 199. Ph
Tenebrio. Fabr. leria.

Anterior tibiæ elongate-trigonate. Tarsi short. Antennæ gradually thickening towards their extremities, where they are perfoliated. Body oval.

Sp. 1. *Cadaverina.* Cadaveri
Tenebrio cadaverina. Fabr.
Inhabits sandy places.

Genus CC. Diaperis. Geoff. Fabr. Oliv. Lam. 200. Di-
Chrysomela. Linn. Marsh. peris.
Tenebrio. De Geer.

Antennæ gradually enlarging towards their extremitabolia.

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* The Genus Boros of Herbst, the type of which is *Hypophæus boros* of Fabricius, is unknown to us.

† An artificial family.

ties, from the fourth joint perfoliated. Body nearly hemispheric, very convex above.

ti.

Sp. 1. *Boleti.*

Diaperis boleti of authors.

Chrysomela boleti. Linn. Marsh.

Inhabits the boleti of trees.

Eus-
PHUS.

GENUS CCI. EUSTROPHUS. Latr.

MYCETOPHAGUS. Fabr.

Antennæ gradually enlarging towards their extremities. Thorax large, almost semicircular. Head much deflexed.

mes-
s.

Sp. 1. *Dermestoides.*

Mycetophagus dermestoides. Fabr.

Eustrophus dermestoides. Latr.

. TE-
TOMA.

GENUS CCII. TETRATOMA. Herbst, Fabr. Payk.

Antennæ terminated by a club of four joints, the other joints very small. Body oval. Tibiæ not spiny.

gorum.

Sp. 1. *Fungorum.*

Tetratoma fungorum. Fabr. Payk. Latr.

Inhabits Europe.

LEIOI-

GENUS CCIII. LEIOIDES. Latr.

ANISOTOMA. Illig. Fabr.

SPHÆRIDIUM. Olivier.

TETRATOMA. Herbst.

Antennæ abruptly terminated by a five-jointed club, the eight joint (the second of the club) very small. Thorax almost hemispheric. Tibiæ spinose.

a.

Sp. 1. *Picea.*

Anisotoma piceum. Illiger.

Anisotoma picea. Panzer.

Leioides picea. Latr.

Inhabits Europe.

. TRA-
SCELIS.

GENUS CCIV. TRACHYSCELIS. Latr.

MYCETOPHAGUS. Fabr.

Antennæ abruptly terminated by a much perfoliated six-jointed club. Body rounded, elevated. Feet formed for digging. Tibiæ very spiny.

odioi-

Sp. 1. *Aphodioides.*

Trachyscelis aphodioides. Latr.

Inhabits Egypt.

. COSSY-
s.

GENUS CCV. COSSYPHUS. Oliv. Fabr. Herbst, Latr.

Head concealed under the thorax. Scutellum distinct. Abdomen included in a canal formed by the elytra. Feet compressed. Labium naked. Mentum transverse cordate-quadrate. Maxillary palpi, elongate; the last joint securiform. Mandibles abruptly attenuated.

ressus.

Sp. 1. *Depressus.*

Cossyphus depressus. Fabr. Oliv. Herbst, Latr.

Inhabits the East Indies.

man-
ii.

Sp. 2. *Hoffmanseggii.*

Cossyphus Hoffmanseggii. Latr.

Inhabits Barbary and Portugal.

Subdivision 2.

Antennæ terminated by joints resembling in their form the teeth of a saw.

ELE-

GENUS CCVI. ELEDONA. Latr.

BOLITOPHAGUS. Illig. Fabr.

OPATRUM. Oliv. Marsh.

DIAPERIS. Olivier.

Palpi filiform; maxillary ones with their last joint almost cylindric. Antennæ arcuate. Body oval, convex, generally rough. Thorax transverse, emarginate before; the side often with acute margins.

ricola.

Sp. 1. *Agaricola.*

Eledona agaricola. Latr.

Opatrum agaricola. Oliv. Marsh.

Bolitophagus agaricola. Illig. Fabr.

Inhabits Boleti and other Fungi.

Metabolia.

GENUS CCVII. EPITRAGUS. Latr.

207. EPI-
TRAGUS.

Maxillary palpi with the last joint large obtrigonate. Antennæ with the four last joints dentiform. Mentum very large. Body elliptic or oblong. Thorax quadrate, or trapeziform.

Sp. 1. *Fuscus.*

Fuscus.

Epitragus fuscus. Latr.

Inhabits Cayenne.

GENUS CCVIII. CNODALON. Fabr. Latr.

208. CNO-
DALON.

Maxillary palpi with the last joint very large, securiform. Antennæ with the six last joints dentiform. Mentum not very large. Body oval, very convex. Thorax transverse.

Sp. 1. *Viride.*

Viride.

Cnodalon viride. Latr. *Gen. Crust. et Ins.* 2 tab. 10. fig. 1.

Inhabits the West Indies.

DIVISION IV.

Antennæ nearly or quite filiform, with their extremities simple.

Subdivision 1.

Mandibles with their extremities bifid.

GENUS CCIX. HELOPS. Fabr. Oliv. Lam. Illig. Latr. Rossi.

209. HE-
LOPS.

TENEBRIO. Linn.

Maxillary palpi terminated by a securiform joint. Antennæ as long or longer than the thorax. Thorax quadrate or semicircular. Body convex.

Obs. This genus is artificial; it comprehends the genera *Helops*, *Platynotus*, and part of *Melandrya* of Fabricius, and part of the genus *Serropalpus* of Illiger, and the rejected genus *Heleus* of Latreille.

Sp. 1. *Lanipes.*

Lanipes.

Helops Lanipes. Fabr. Latr. Oliv.

Tenebrio Lanipes. Linn.

Inhabits Europe.

GENUS CCX. PYTHO. Latr. Fabr.

210. PY-
THO.

TENEBRIO. Linn.

CUCUJUS. Paykull.

Maxillary palpi terminated by a large almost obtrigonate joint. Antennæ shorter than the thorax. Body depressed. Thorax almost orbicular.

Sp. 1. *Cœruleus.*

Cœruleus.

Pytho cœruleus. Latr. Fabr.

Cucujus cœruleus. Paykull.

Tenebrio depressus. Linn.

Inhabits the mountains of France, Germany and Sweden, under the bark of trees.

GENUS CCXI. HALLOMENUS. Hellwig, Paykull, Latreille.

211. HAL-
LOMENUS.

DIRCÆA. Fabr.

SERROPALPUS. Illiger.

DINOPHORUS. Illiger.

Palpi almost filiform; the last joint of the maxillary ones almost cylindric.

Sp. 1. *Humeralis.*

Humeralis.

Hallomenus humeralis. Panzer.

Hallomenus Bipunctatus. Paykull.

Serropalpus humeralis. Illiger, *Col. Bor.* 1. 134.

Dircæa humeralis. Fabr.

Inhabits Boleti, and under the bark of trees.

Subdivision 2.

Mandibles with their points entire. Tarsi with denticulated nails.

212. Cistela.

Genus CCXII. Cistela. Fabr. Latr. Lam. Oliv.
Chrysomela. Linn.
Mordella. Geoffroy.
Body ovate. Antennæ serrated. Feet rather long.

Ceramboides.

Sp. 1. *Ceramboides.*
Cistela ceramboides. Fabr. Latr. Oliv.
Chrysomela ceramboides. Linn.
Inhabits Europe.

Family 3. *Melyandrida.*

Four anterior tarsi with the last joint but one bilobate. Maxillary palpi with the last joint large, securiform, or obtrigonate.

Division I.

Hinder tarsi with entire joints.

213. Serropalpus.

Genus CCXIII. Serropalpus. Oliv. Paykull, Illig. Latr.
Dircæa. Fabr.
Antennæ filiform. Body almost cylindric, and very long.

Striatus.

Sp. 1. *Striatus.*
Serropalpus striatus. Paykull, Illig. Latr.
Dircæa barbata. Fabr.
Inhabits Europe.

214. Dircæa.

Genus CCXIV. Dircæa. Fabr.
Orchesia. Latr.
Hallomenus. Illig. Paykull, Hellwigg.
Megatoma. Herbst.
Mordella. Marsham.
Hinder feet formed for leaping. Antennæ clavate. Body elliptic.

Micans.

Sp. 1. *Micans.*
Dircæa micans. Fabr.
Hallomenus micans. Paykull.
Serropalpus micans. Illiger, *Col. Bor.* 1. 135.
Megatoma picea. Herbst.
Mordella boleti. Marsh.
Orchesia micans. Latr.
Inhabits Boleti.

Division II.

Tarsi altogether with their last joint but one bilobate.

215. Melandrya.

Genus CCXV. Melandrya.* Fabr. Latr.
Chrysomela. Linn.
Serropalpus. Illiger, Bosc.
Antennæ simple, filiform. Maxillary palpi terminated by an elongate securiform joint. Body nearly elliptic. Thorax trapezoid, broad behind.

Caraboides.

Sp. 1. *Caraboides.*
Chrysomela caraboides. Linn.
Serropalpus caraboides. Olivier, Illiger.
Melandra serrata. Fabr. Latr.
Criocertis caraboides. Marsh.
Inhabits rotten trees.

216. Lagria.

Genus CCXXVI. Lagria. Fabr. Oliv. Lam.
Chrysomela. Linn.
Cantharus. Geoff.
Tenebrio. De Geer.
Antennæ simple, insensibly growing thicker towards their extremity. Maxillary palpi double the size of the labial palpi, with the last joint large, securiform; labial palpi with the last joint ovate. Body oblong, (generally villose.)

Hirta.

Sp. 1. *Hirta.*
Lagria hirta. Fabr. Latr.
Chrysomela hirta. Linn.
Inhabits Europe.

217. Nilio.

Genus CCXVII. Nilio. Latr.
Ægithus. Fabr.
Coccinella. Fabr.
Antennæ filiform, simple. Maxillary palpi terminated by an obtrigonate joint. Body hemispheric.

Villosus.

Sp. 1. *Villosus.*
Ægithus marginatus. Fabr.
Nilio villosus. Latr.
Inhabits Cayenne.

218. Calopus.

Genus CCXVIII. Calopus. Fabr. Oliv. Paykull, Latr.
Cerambyx. Linn. De Geer.
Antennæ filiform, serrated. Body narrow, very much elongated, almost linear. Maxillary palpi terminated by a securiform joint.

Serraticornis.

Sp. 1. *Serraticornis.*
Calopus serraticornis. Fabr. Oliv. Latr.
Cerambyx serraticornis. Linn.
Inhabits northern Europe.

Tribe III. Pyrochroides.

Head cordiform, abruptly strangulated at its junction with the thorax. Tarsi with their penultimate joints all bilobate. Body elongate, depressed, or convex and cylindric. Thorax almost cordate.

Division I.

Antennæ pectinated, serrated, or branched.

219. Dendroides.

Genus CCXIX. Dendroides. Latr.
Antennæ branched. Thorax conic.

Canadensis.

Sp. 1. *Canadensis.*
Dendroides canadensis. Latr.
Inhabits Canada.

220. Pyrochroa.

Genus CCXX. Pyrochroa. Fabr. Geoff. De Geer, Oliv. Latr.
Canthaeris. Linn.
Antennæ pectinated or serrated. Thorax orbicular. The prevailing colour in this genus is red and black.

Rubens.

Sp. 1. *Rubens.*
Pyrochroa rubens. Fabr. Lat. Oliv.
Inhabits Europe.

Coccinea.

Sp. 2. *Coccinea.*
Cantharis coccinea. Linn.
Pyrochroa coccinea. Fabr. Latr.
Inhabits France, Germany, and England.

Division II.

Antennæ simple.

221. Sca tia.

Genus CCXXI. Scraptia. Latr.
Labial palpi terminated by a semilunar, or large triangular joint. Thorax almost semicircular.

Fusca.

Sp. 1. *Fusca.*
Scraptia fusca. Latr.
Inhabits France.

222. Notoxus.

Genus CCXXII. Notoxus. Geoff. Oliv. Illiger, Latr.
Melöe. Linn. Donovan.
Anthicus. Paykull, Fabr.
Labial palpi terminated by a small truncate joint. Thorax almost cordiform, produced into a porrected horn in front.

Monocer

Sp. 1. *Monoceros.*
Melöe monoceros. Linné, Donovan.
Notoxus monoceros. Olivier, Illiger, Latr.
Anthicus monoceros. Fabr. Payk.
Inhabits Europe.

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* *Hypulus quercinus* of Paykull is possibly referable to this genus.

223. Anthicus. GENUS CCXXIII. ANTHICUS. Payk. Fabr. Leach.

NOTOXUS. Illiger, Latr.

LYTTA. Marsham.

Labial palpi terminated by a small truncate joint. Thorax almost cordiform, not anteriorly produced.

Fusca. *Sp.* 1. ***Fusca.***

Lytta fusca. Marsham.

Inhabits Europe.

Antherinus. *Sp.* 2. *Antherinus.*

Anthicus antherinus. Payk. Fabr.

Notoxus antherinus. Latr. Illiger.

Lytta antherina. Marsham.

Inhabits Europe.

TRIBE IV. MORDELLIDES.

Head cordiform, abruptly strangulated at its junction with the thorax. Hinder tarsi (sometimes the others) with their penultimate joint entire. Body elevated, arcuate, laterally compressed, and terminated by a point. Head very large. Elytra very short, or very narrow and pointed behind. Hinder feet large. Tibiæ with spurs.

224. Rhipiphorus. GENUS CCXXIV. RHIPIPHORUS. Bosc, Fabr. Payk. Oliv. Latr.

MORDELLA. Linn. Marsh.

Tarsi with all the joints simple. Palpi almost filiform. Antennæ pectinated or flabellate. Scutellum none, or concealed.

Paradoxus. *Sp.* 1. *Paradoxus.*

Mordella paradoxa. Linn.

Rhipiphorus paradoxus. Latr.

Inhabits Europe. It is extremely rare. The larvæ inhabit the nests of *Vespa crabro, (the hornet)*.

Mordella paradoxa of Marsham, which is distinct from the Linnean species, has been found in the nest of a wasp, perhaps in that of *Vespa vulgaris.*

225. Mordella. GENUS CCXXV. MORDELLA. Linn. Geoff. Fabr. Latr. Marsh.

Tarsi with all their joints simple. Maxillary palpi terminated by a securiform joint. Antennæ simple, or very slightly serrated. Scutellum distinct.

Aculeata. *Sp.* 1. *Aculeata.*

Mordella aculeata. Linn. Fabr. Latr. Oliv.

Inhabits Europe.

226. Anaspis. GENUS CCXXVI. ANASPIS. Latr. Geoff.

MORDELLA. Linn. Fabr. Oliv. Marsh.

Penultimate joint of the four anterior tarsi bilobate. Maxillary palpi with the last joint securiform. Scutellum none.

Frontalis. *Sp.* 1. *Frontalis.*

Mordella frontalis. Fabr. Oliv. Payk. Marsham.

Anaspis frontalis. Latr.

Inhabits flowers in Europe, especially of umbellate plants.

Subdivision 2.

Head not produced into a rostrum, bearing antennæ. Antennæ simple. Tarsi with bifid nails.

TRIBE V. CANTHARIDES.

Head large, cordiform. Neck distinct. Mandibles not notched at their points. Thorax almost quadrate, or cordiform. Elytra flexible. Tarsi generally with entire joints.

FAMILY I. *Cerocomatida.*

Antennæ clavate, or gradually thickening towards their extremity.

227. Cerocoma. GENUS CCXXVII. CEROCOMA. Geoff. Schæff. Fabr. Oliv. Latr.

MELÖE. Linn.

Antennæ (of the males) irregular, nine-jointed, the last joint very large. Elytra horizontal.

Schæfferi. *Sp.* 1. *Schæfferi.*

Melöe schæfferi. Linn.

Cerocoma schæfferi. Latr. Fabr. Oliv.

Inhabits the south of Europe.

228. Mylabris. GENUS CCXXVIII. MYLABRIS. Fabr. Oliv. Lamarck, Latr.

Antennæ eleven-jointed, terminated by an arcuate mass, ending in a point. Elytra deflexed-subrounded.

Decempunctata. *Sp.* 1. *Decempunctata.*

Mylabris decempunctata. Fabr. Oliv. Latr.

Inhabits southern France.

FAMILY II. *Melöida.*

Antennæ of equal thickness, tapering towards their points, or subclavate, as long or longer than the thorax, composed of globular or obconic joints.

DIVISION I.

Penultimate joint of all the tarsi bifid.

229. Tetraonyx. GENUS CCXXIX. TETRAONYX. Latr.

Antennæ subfiliform, scarcely gradually somewhat thicker. Thorax short, transverse, quadrate.

Octomaculatus. *Sp.* 1. *Octomaculatus.*

Tetraonyx octomaculatus. Latreille, *Voyage de M. Alex. de Humboldt*, &c. p. 237.

DIVISION II.

Tarsi with all their joints entire.

Subdivision 1.

Elytra covering the whole abdomen; their suture straight. Wings in all.

230. Horia. GENUS CCXXX. HORIA. Fabr. Oliv. Latr.

Head as broad as the thorax. Antennæ straight, compressed, inserted before the eyes. Palpi with their last joint oval. Tarsi with their nail denticulate beneath. Body thick.

Maculata. *Sp.* 1. *Maculata.*

Horia maculata. Fabr. Oliv. Latr.

Inhabits American islands.

231. Cissites. GENUS CCXXXI. CISSITES. Latr. (rejected by this author), Leach.

HORIA. Latr. Fabr. Oliv.

Head narrower than the thorax. Antennæ straight, compressed, inserted before the eyes. Palpi with their last joint oval. Tarsi with their nails denticulated beneath. Body thick.

Testacea. *Sp.* 1. *Testacea.*

Horia testacea. Latr. Fabr. Oliv.

Inhabits Tranquebar.

232. Œnas. GENUS CCXXXII. ŒNAS. Latr.

MELÖE. Linn.

LYTTA. Fabr.

CANTHARIS. Olivier.

Antennæ crooked, inserted between the eyes. Palpi with the last joint cylindric. Body elongate, rounded.

Afer. *Sp.* 1. *Afer.*

Melöe afer. Linn.

Lytta afer. Fabr.

Œnas afer. Latr.

Inhabits Barbary.

Subdivision 2.

Elytra covering only a part of the abdomen; short, oval, diverging at the suture. Wings none.

Metabolia.

233. Meloë. GENUS CCXXXIII. MELOË. Linn. Geoff. De Geer, Fabr. Pallas, Olivier, Lamarck, Mayer, Latr. Leach.

Abdomen very large, generally soft. Antennæ various.

In the 11th volume of the *Transactions of the Linnean Society of London*, two papers by Dr Leach, on the species of this genus, may be found, in which the species are arranged, from the structure of their antennæ, into the following Sections.

* Antennæ filiform.

A. Longer than the thorax and head.

B. Shorter than the thorax and head.

a. The terminal joint emarginate.

b. The terminal joint entire.

* * Antennæ thicker externally.

A. Thorax elongate.

B. Thorax transverse.

* * * Antennæ thicker, and curved in the middle.

FAMILY III. *Cantharida.*

Antennæ composed of cylindric or obconic joints, longer than the thorax.

234. Cantharis. GENUS CCXXXIV. CANTHARIS. Geoff. De Geer, Olivier, Lamarck, Latreille.

MELOË. Linn.

LYTTA. Fabr. Marsh.

Elytra soft, elongate, linear, with the sides somewhat inflexed, the back convex, rounded. Maxillæ with two membranaceous laciniæ, the external one acute within, subuncinate. Antennæ with the first joint larger than the others; the second very short, transverse; the rest obconic; the last ovoid.

Vesicatoria. *Sp.* 1. *Vesicatoria, (Spanish fly).*

Meloë vesicatorius. Linn.

Cantharis vesicatoria. De Geer, Geoff. Oliv. Latr.

Lytta vesicatoria. Marsh. Fabr.

Inhabits Europe; is found on the ash, but is rare in England; it is the common *blister-fly* of our shops.

235. Zonitis. GENUS CCXXXV. ZONITIS. Fabr. Latr.

APALUS. Oliv.

Elytra elongate, linear, soft, covering the whole of the abdomen, the sides a little inflected. Maxillæ not produced. Antennæ with the first joint of the same length with the third; the second a little shorter, obconic; the third and following cylindric; the last fusiform, abruptly terminated by a short point.

Præusta. *Sp.* 1. *Præusta.*

Zonitis præusta. Fabr. Latr.

Inhabits southern Europe.

236. Nemognatha. GENUS CCXXXVI. NEMOGNATHA. Illiger, Latr.

ZONITIS. Fabr.

Elytra elongate, linear. Maxillæ very much produced, filiform, and curved.

Vittata. *Sp.* 1. *Vittata.*

Zonitis vittata. Fabr.

Nemognatha vittata. Latr. Illiger.

237. Apalus. GENUS CCXXXVII. APALUS. Oliv. Latr. Fabr.

Elytra abruptly attenuated towards their extremity. Antennæ with the two first joints shorter than the third.

Apicalis. *Sp.* 1. *Apicalis.*

Sitaris apicalis. Latr. *Gen. Crust. et Ins.* ii. 222.

Apalus apicalis. Latr. *Consid.*

Inhabits southern France.

Subdivision 3.

Head produced into a rostrum bearing antennæ. Body nearly linear. Thorax cylindric. Antennæ setaceous or filiform, composed of elongate, cylindric joints. Maxillary palpi terminated by a large obtrigonate joint. Tarsi with the penultimate joints bilobate. Nails simple.

TRIBE VI. ŒDEMERIDES.

Antennæ filiform or setaceous. Rostrum not very flat, and dilated at its extremity.

238. Œ-mera. GENUS CCXXXVIII. ŒDEMERA. Latr. Oliv.

NECYDALIS. Linn. Fabr.

Antennæ inserted at the anterior internal margin of the eyes. Rostrum not elongate. Eyes prominent. Elytra subulate. Palpi with the last joint broader than the penultimate joint.

Cærula. *Sp.* 1. *Cærulea.*

Necydalis cærulea. Linnæus, Fabricius.

Œdemera cærulea. Latreille, Olivier.

Inhabits Europe.

239. Ste-nostom. GENUS CCXXXIX. STENOSTOMA. Latreille.

LEPTURA. Fabricius.

Antennæ inserted on the rostrum beyond the eyes. Rostrum elongate, acute. Eyes not prominent. Elytra long, flexible, not subulate. Palpi with the last joint cylindric.

Rostrat. *Sp.* 1. *Rostrata.*

Leptura rostrata. Fabricius.

Œdemera rostrata. Latreille, *Gen. Crust. et Ins.*

Stenostoma rostrata. Latr. *Considerat.* 217.

240. My-terus. GENUS CCXL. MYCTERUS. Clairville, Olivier.

RHINOMACER. Fabr. Latr.

MYLABRIS. Schæffer.

Antennæ inserted before the eyes on the rostrum. Rostrum elongate, narrow. Eyes globose, prominent. Elytra hard. Palpi with the last joint compressed.

Curculionides. *Sp.* 1. *Curculionides.*

Rhinomacer curculionides. Fabricius, Latreille.

Mycterus griseus. Clairville.

Inhabits Europe; and has been taken in South Devon by Mr J. Cranch of Kingsbridge.

TRIBE VII. SALPINGIDES.

Antennæ thicker at their extremities. Rostrum very flat, and dilated at its extremity.

241. Salpingus. GENUS CCXLI. SALPINGUS. Illiger.

CURCULIO. Linn. De Geer, Marsh.

ANTHRIBUS. Fabricius, Paykull, Panzer, Clairville.

RHINOSIMUS. Latreille.

Antennæ inserted before the eyes. Elytra rigid.

Roboris. *Sp.* 1. *Roboris.*

Anthribus roboris. Paykull, Fabricius, Clairville.

Rhinosimus roboris. Latreille.

Curculio ruficollis? Linnæus.

Inhabits Europe, beneath the bark of trees.

SECTION III. TETRAMERA.

Tarsi with four joints.

DIVISION I.

RYNCHOPHORI. Latreille.

Head anteriorly rostrated; the mouth at the apex of the rostrum.

TRIBE I. BRUCHIDES.

Palpi obvious, filiform, not very minute. Rostrum broad. Labrum exserted. Antennæ eleven-jointed; subclavate, with the club formed of distinct joints, in some; filiform, or gradually thicker towards their points, in others; serrated, or pectinated.

242. Platyrhinus. GENUS CCXLII. PLATYRHINUS. Clairville.

ANTHRIBUS. Fabricius, Geoffroy, Paykull, Latr.

MACROCEPHALUS. Olivier.

Antennæ clavate, the club elongate. Eyes not emarginate. Elytra covering the anus above. Body ovate-oblong. Abdomen somewhat elongate-quadrate, rounded behind. Thorax somewhat quadrate, a little narrower before. Rostrum broad. Head scarcely narrower at the base.

Latirostris. Sp. 1. *Latirostris.*

Anthribus latirostris. Fabricius, Latreille, Paykull.

Platyrhinus latirostris Clairville.

Macrocephalus latirostris. Olivier.

Inhabits woods in Europe.

243. Anthribus. GENUS CCXLIII. ANTHRIBUS. Paykull, Fabricius, Latreille, Geoffroy.

MACROCEPHALUS. Olivier.

Antennæ clavate, the club ovate, abrupt, incressated. Eyes not emarginate. Elytra covering the anus above. Body short, oval, thick. Thorax transverse, broader behind, lobated. Rostrum short.

Scabrosus. Sp. 1. *Scabrosus.*

Anthribus scabrosus. Paykull, Fabricius, Latreille.

Macrocephalus scabrosus. Olivier.

Inhabits the elm.

244. Rhinomacer. GENUS CCXLIV. RHINOMACER. Olivier, Fabricius.

ANTHRIBUS. Paykull, Latreille.

Antennæ clavate. Eyes not emarginate. Elytra covering the anus above. Abdomen elongate, narrow. Thorax roundish, nearly equally broad. Rostrum at the base much narrower than the head, the longitudinal diameter many times exceeding the breadth. Tarsi, with the second joint not including the third.

Attelaboides. Sp. 1. *Attelaboides.*

Anthribus rhinomacer. Paykull, Latreille.

Rhinomacer attelaboides. Fabricius.

Inhabits pine trees.

245. Bruchus. GENUS CCXLV. BRUCHUS. Linn. De Geer, Olivier, Fabricius, Latreille, Marsham.

MYLABRIS. Geoffroy.

Antennæ nearly filiform. Eyes emarginate, for the insertion of the antennæ. Body short, oval, thick. Elytra not covering the anus above.

Pisi. Sp. 1. *Pisi.*

Bruchus pisi. Linn. Fabr. Oliv. Latr.

Inhabits southern Europe and northern America.

TRIBE II. CURCULIONIDES.

Palpi very small, conic-subulate, scarcely discernible. Rostrum rounded, thick, often proboscis shaped. Labrum none. Antennæ with distinct joints, the eighth or ninth generally clavate, the club regular, the joints coriaceous. Head from the eyes more or less narrowed, distinctly produced into a rostrum. Mandibles small or minute. Mentum not cylindric-cordate. Body very rarely cylindric. Anterior tibiæ never triangular.

DIVISION I.

(Recticornes; straight horns.)

Antennæ straight, not geniculated at the second joint. Body of all, from the base of the thorax, narrower, not cylindric.

6. Bren-s. GENUS CCXLVI. BRENTUS. Fabricius, Olivier, Herbst, Latreille, Lamarck.

CURCULIO. Linnæus, De Geer.

Mandibles generally prominulous, the apex generally bidentate. Body very long, somewhat cylindric, narrower before, straight, porrect. Thorax elongate-ovate, truncate before and behind. Elytra rigid, elongate, linear, with the apex often spinose. Feet elongate, strong, the anterior ones longest. Mentum corneous, cordate-subovate, apex emarginate, base rounded, concave in front.

Anchorago. Sp. 1. *Anchorago.*

Brentus anchorago. Fabricius, Latreille.

Inhabits America.

247. Cylas. GENUS CCXLVII. CYLAS. Fabr.

BRENTUS. Olivier, Fabricius.

Mandibles short, the apex bidentate. Mentum suborbiculate. Body elongate, narrow before. Thorax articulated, dilated in front, and ovate-subglobose, strangulated behind. Elytra with prominent shoulders. Tarsi with the last joint but one bifid.

Brunneus. Sp. 1. *Brunneus.*

Cyclus brunneus. Latreille.

Brentus brunneus. Herbst, Fabr.

Inhabits Senegal.

248. Attelabus. GENUS CCXLVIII. ATTELABUS. Linn. Fabr. Oliv. Latr.

CURCULIO. De Geer.

Head behind simply elongate, produced with no neck. Tibiæ with their points furnished with a double hook. Body ovate. Abdomen quadrate, rounded behind. Labium corneous, quadrate, the middle of the upper margin emarginate, obtusely unidentate.

Curculionoides. Sp. 1. *Curculionoides.*

Attelabus curculionoides. Linnæus, Latreille, Olivier.

Inhabits the nut tree and willow.

249. Apoderus. GENUS CCXLIX. APODERUS. Olivier, Latreille.

ATTELABUS. Linnæus, Fabricius, Paykull.

Head with a distinct neck. Tibiæ with one hook at their joints. Body ovate. Abdomen quadrate, rounded behind. Labium corneous, quadrate, the middle of the upper margin emarginate, obtusely unidentate.

Coryli. Sp. 1. *Coryli.*

Attelabus coryli. Linn. Fabr. Payk. Latr.

Curculio coryli. Marsham.

Inhabits the nut tree.

250. Rynchites. GENUS CCL. RYNCHITES. Herbst, Latr.

CURCULIO. Linnæus, De Geer, Marsham.

RHINOMACER. Geoffroy, Clairville.

ATTELABUS. Fabricius, Olivier.

Head elongate behind the eyes, with no neck. Clypeus dentate. Tibiæ with very short heels. Abdomen quadrate, rounded behind. Body ovate, narrowly produced before. Thorax conic-cylindric, broader behind, (often with a spine on each side in the male). Labium membranaceous, small, the apex rounded, villose, entire.

Bacchus. Sp. 1. *Bacchus.*

Curculio bacchus. Linnæus, Marsham.

Rynchites bacchus. Herbst, Latreille.

Attelabus bacchus. Fabricius.

Inhabits Europe, frequenting the nut and vine.

251. Apion. GENUS CCLI. APION. Herbst, Latreille, Kirby.

CURCULIO. Linnæus, Marsham.

RHINOMACER. Geoffroy, Clairville.

ATTELABUS. Fabricius, Olivier.

Eyes prominulous. Head elongate behind. Abdomen subovate. Tibiæ with obsolete heels. Labium subquadrate, entire.

Obs. The Rev. William Kirby has given an admirable paper to the Linnæan Society of London on the species of this genus, which is published in the ninth volume of their Transactions. He has added a supplement, which is published in the tenth volume.

252. Rhamphus. GENUS CCLII. RHAMPHUS. Clairville.

Tarsi with the last joint but one bifid, cordiform. Head globose. Eyes approximate. Hinder feet formed for leaping. Tibiæ with obsolete heels. Body short, oval.

Metabolia.

Flavicornis. *Sp.* 1. ***Flavicornis.***

Ramphus flavicornis. Latreille, Clairville.

Inhabits the sloe and aspen.

253. BRACHYCERUS. GENUS CCLIII. BRACHYCERUS. Olivier, Herbst, Fabricius, Latreille.

CURCULIO. Linnæus, De Geer.

Tarsi short, with entire joints. Lip crustaceous, suborbicular, the apex truncate, retuse, entire. Body ovate, thick, gibbous. Eyes lateral. Tibiæ with their two points produced, the internal spine bifid. Thorax transverse. Abdomen large, subglobose, ovate, or oval.

Algirus. *Sp.* 1. *Algirus.*

Brachycerus algirus. Fabr. Latr.

Inhabits Africa.

DIVISION II.

(Fracticornes; geniculated horns.)

Antennæ geniculated, the basal joint very much elongated, generally received in a lateral oblique groove, (at the base at least,) or the sides of the rostrum.

(Antennæ in all clavate, the club generally composed of firmly connected joints, the last acute. Tarsi with the last joint but one bifid, or emarginate above, cordate.)

Subdivision 1.

Antennæ inserted beyond the base of the rostrum, larger than the head, the club distinctly many-jointed, ovate. Mandibles generally obtuse. Tibiæ at the apex ciliated with spines, in a few terminated by a strong hook. Body ovate, or elliptic. Colour various.

254. CURCULIO. GENUS CCLIV. CURCULIO. Linnæus, Fabricius, Clairville, Olivier.

BRACHYRHINUS. Latreille.

Body ovate, convex, narrower before. Thorax round, or conic-cylindric, narrower than the base of the elytra. Scutellum extremely minute. Abdomen ovate-conic, subovate, or globose. Lip minute. Antennæ eleven-jointed. Hinder feet not formed for leaping.

Imperialis. *Sp.* 1. *Imperialis,* (diamond beetle.)

Curculio imperialis. Linn. Fabr. Oliv.

Brachyrhinus imperialis. Latreille.

Inhabits Brasil.

Argentatus. *Sp.* 2. *Argentatus.*

Curculio argentatus. Gmelin, Marsh. Fabr.

Brachyrhinus argentatus. Latreille.

Inhabits Europe.

255. LIXUS. GENUS CCLV. LIXUS. Latreille, Fabricius.

CURCULIO. Linnæus, Geoffroy, Marsham, Fabricius.

Body elongate-ovate. Rostrum as broad as the head. Lip small, entire, transverse-quadrate, corneous, narrower than the mentum.

Sulcirostris. *Sp.* 1. *Sulcirostris.*

Curculio sulcirostris. Linnæus, Fabricius, Marsham.

Inhabits thistles.

Paraplecticus. *Sp.* 2. *Paraplecticus.*

Curculio paraplecticus. Linn.

Lixus paraplecticus. Fabricius, Latreille.

Inhabits the *Phellandrium aquaticum.*

256. RYNCHÆNUS. GENUS CCLVI. RYNCHÆNUS. Fabricius, Olivier.

CURCULIO. Linn. Geoff. Lam. Latr.

Body oblong, ovate, twice as long as broad. Antennæ with the club three-jointed beginning at the ninth joint, or eight four-jointed beginning at the eighth joint. Wings in all.

Tortrix. *Sp.* 1. *Tortrix.*

Curculio tortrix. Linnæus, Marsham, Latreille.

Rynchænus tortrix. Fabricius.

Inhabits Europe.

Abietis. *Sp.* 2. *Abietis.*

Curculio abietis. Linnæus.

Metabolia.

Inhabits Europe in the pine. It was discovered as a native of Britain by Dr Malden, who took it near Hameton, in Scotland.

Pini. *Sp.* 3. *Pini.*

Curculio pini. Linn. Marsham.

Inhabits the *Pinus sylvestris.*

257. LIPARUS. GENUS CCLVII. LIPARUS. Oliv.

CURCULIO. Linnæus, Latreille, Marsham.

RYNCHÆNUS. Fabricius.

Body oblong ovate, twiee as long as broad. Antennæ with the club three-jointed beginning at the ninth joint, or four-jointed beginning at the eighth joint. Wings none.

Germanus. *Sp.* 1. *Germanus.*

Curculio Germanus. Linnæus, Marsham.

Rynchænus fusco-maculatus. Fabricius.

Inhabits Europe. It occurs in Britain, near Dover and Hastings.

Triguttatus. *Sp.* 2. *Triguttatus.*

Curculio triguttatus. Marsham, Latreille.

Curculio vau of Marsham, is merely a variety of this insect.

Inhabits Europe.

258. CRYP TORYN-CUS. GENUS CCLVIII. CRYPTORYNCUS. Illiger.

CURCULIO. Linnæus, Marsham.

RYNCHÆNUS. Fabricius.

Body round-oval, half as long again as broad. Abdomen short, triangular-quadrate. Anus naked. Rostrum applied to the breast. Coleoptra subquadrate, the diameters nearly equal. Hinder feet not formed for leaping. Mentum corneous, subobtrigonate.

Erysimi. *Sp.* 1. *Erysimi.*

Rynchænus erysimi. Fabr.

Crytorynchus erysimi. Illiger.

Inhabits Europe.

259. CIONUS. GENUS CCLIX. CIONUS. Clairville, Latreille.

RYNCHÆNUS. Fabr.

CURCULIO. Linn. Geoff. Oliv.

Body quadrate-ovate, thick, a little longer than broad. Abdomen large, subquadrate, a little narrower, and rounded behind. Anus not naked. Rostrum applied to the breast. Coleoptra convex, as broad as long, inflexed behind. Hinder feet not formed for leaping.

Scrophulariæ. *Sp.* 1. *Scrophulariæ.*

Curculio scrophulariæ. Linnæus, Marsham.

Rynchænus scrophulariæ. Fabricius.

Cionus scrophulariæ. Clairville.

Inhabits the *Verbascum* and *Scrophularia.*

Latreille supposes *Rynchænus, Thapsus, Scrophulariæ,* and *Verbasci* of Fabricius, to be but varieties of one species.

260. O CHESTE GENUS CCLX. ORCHESTES. Olivier, Illiger.

RYNCHÆNUS. Clairville, Fabricius, Latreille.

CURCULIO. Linnæus, Marsham.

Body ovate. Abdomen elongate-quadrate, rounded behind. Elytra inflexed behind, covering, or at least touching the anus. Hinder feet formed for leaping.

Alni. *Sp.* 1. *Alni.*

Curculio alni. Linnæus, Marsham.

Rynchænus alni. Fabricius.

Inhabits Europe.

Subdivision 2.

Antennæ inserted at the base of the rostrum. Tarsi reflected to the internal side of the tibiæ.

261. R NA. GENUS CCLXI. RHINA. Latreille.

LIXUS. Fabricius.

CURCULIO. Olivier.

Body oblong cylindric. Feet elongate, especially the

Metabolia. anterior ones. Tibiæ slender. Rostrum elongate, porrect, cylindric, slender, often bearded.

Barbirostris. *Sp.* 1. *Barbirostris.*
Lixus barbirostris. Fabricius.
Rhina barbirostris. Latreille.
Inhabits Africa and India.

262. Calandra. Genus CCLXII Calandra. Clairville, Fabricius.
Curculio. Linnæus, Geoffroy, Olivier.
Rynchophorus. Herbst.

Body elliptic-oval, flat above. Eyes immersed, oblong, encircling the head beneath. Rostrum thickened at the insertion of the antennæ. Elytra plain, not covering the anus above. Anus acutely prominent. Feet strong.

Granaria. *Sp.* 1. *Granaria.*
Calandra granaria. Fabricius, Latreille.
Curculio granaria. Marsham.
Inhabits Europe.

263. Cossonus. Genus CCLXIII. Cossonus. Clairville, Fabricius, Latreille.
Curculio. Paykull, Herbst.

Body very much lengthened, sublinear, or subcylindric, narrow before. Elytra covering the anus above. Tibiæ terminated by a hook internally. Back flat, depressed.

Linearis. *Sp.* 1. *Linearis.*
Cossonus linearis. Clairville, Fabricius, Latreille.
Curculio linearis. Paykull, Marsham.
Curculio parallelopipedus. Herbst.
Inhabits Europe.

Division II.

Head not gradually prolonged into a rostrum. Tarsi not spongy beneath.

Tribe III. Bostricides.

Body cylindric, or globose. Head globose. Tibiæ compressed, the anterior ones dentated. Antennæ eight or ten-jointed; the first joint elongate, the two or three last joints forming a large mass. Tarsi not spongy beneath. Palpi very small, generally conic, rarely filiform.

Division I.

Palpi very small, conic. Antennæ forming a solid mass, shorter, or not much longer than the head.

Subdivision 1.

Club of the antennæ commencing before the ninth joint.

4. Hylurgus. Genus CCLXIV. Hylurgus. Latreille.
Ips. De Geer, Marsham.
Scolytus. Olivier.

Tarsi with their penultimate joint bifid. Antennæ with the club commencing at the eighth joint, very little or not at all compressed.

igniperda. *Sp.* 1. *Ligniperda.*
Scolytus Ligniperda. Olivier.
Hylurgus ligniperda. Latreille.
Inhabits beneath the bark of the pine.

iperda. *Sp.* 2. *Piniperda.*
Ips piniperda. Marsham.
Hylurgus piniperda. Latreille.
Inhabits Britain, perforating the pine bark.

5. Tomicus. Genus CCLXV. Tomicus. Latreille.
Dermestes. Linnæus.
Ips. De Geer.
Bostricus. Fabricius, Paykull.
Scolytus. Olivier.

Tarsi with entire short joints. Antennæ with the club much compressed, beginning at the seventh joint, distinctly annulated. Body not linear.

Typographus. *Sp.* 1. *Typographus.*
Dermestes typographus. Linnæus.
Ips typographe. De Geer.
Bostricus typographus. Fabricius, Paykull.
Ips typographus. Marsham.
Scolytus typographus. Olivier.
Tomicus typographus. Latreille.
Inhabits Europe under the bark of trees, which it gnaws into various labyrinth-like passages.

266. Platypus. Genus CCLXVI. Platypus. Herbst, Latreille.
Bostricus. Hellwig, Fabricius.
Scolytus. Panzer.

Tarsi with entire long joints. Antennæ with the club much compressed, commencing at the sixth joint; annulations not or but slightly distinct. Body linear.

Cylindricus. *Sp.* 1. *Cylindricus.*
Platypus cylindricus. Herbst, Lat.
Bostricus cylindricus. Fabricius.
Scolytus cylindricus. Olivier.
Inhabits France and Germany under the bark of trees.

Subdivision 2.

Antennæ with the club beginning at the ninth joint.

267. Scolytus. Genus CCLXVII. Scolytus. Geoffroy, Schæffer, Olivier, Latreille.
Hylesinus. Fabricius.
Ekkoptogaster. Herbst.
Coptogaster. Illiger.
Ips. Marsham.

Tarsi with their last joint but one bifid. Antennæ with the club compressed, obovoid, the apex rounded.

Destructor. *Sp.* 1. *Destructor.*
Scolytus destructor. Oliv. Lat.
Ips scolytus. Marsham.
Hylesinus scolytus. Fabricius.
Inhabits beneath the bark of the elm.

268. Hylesinus. Genus CCLXVIII. Hylesinus. Fabricius, Lat.
Scolytus. Olivier.
Bostricus. Paykull.

Tarsi with their penultimate joint bifid. Antennæ with the club little or not compressed, ovoid, the extremity pointed.

Crenatus. *Sp.* 1. *Crenatus.*
Hylesinus crenatus. Fabricius, Latreille.
Scolytus crenatus. Olivier.
Inhabits Europe.

Division II.

Palpi very small, conic. Antennæ with the club formed of three leaf-like very long laminæ.

269. Phloitribus. Genus CCLXIX. Phloitribus. Latreille.
Hylesinus. Fabricius.
Scolytus. Fabricius.

Tarsi with the last joint but one bilobate.

Oleæ. *Sp.* 1. *Oleæ.*
Hylesinus oleæ. Fabricius.
Scolytus oleæ. Olivier.
Phloitribus oleæ. Latreille.
Inhabits the olive tree in France.

Division III.

Palpi filiform. Antennæ with the club perfoliated or serrated. Tarsi with their joints entire.

270. Bostricus. Genus CCLXX. Bostricus. Latreille, Olivier.
Ligniperda. Herbst.
Apate. Fabricius, Paykull.
Dermestes. Linnæus.

Metabolia. Body convex. Thorax elevated, globular, or cubic. Maxillæ bilobate.

Capucinus. *Sp.* 1. *Capucinus.*
Ligniperda capucinus. Herbst.
Apate capucinus. Fabricius, Paykull.
Bostricus capucinus. Latreille, Olivier.
Dermestes capucinus. Linnæus.
Inhabits Europe.

271. PSOA. GENUS CCLXXI. PSOA. Fabricius, Latreille, Herbst.
DERMESTES. Rossi.
Body flattened above. Thorax almost quadrate. Maxillæ with one lobe.

Viennensis. *Sp.* 1. *Viennensis.*
Psoa viennensis. Fabricius, Latreille, Herbst.
Dermestes dubius. Rossi.

TRIBE IV. PAUSSIDES.

Body oblong and much depressed. Palpi conic-subulate. Antennæ two, or ten-jointed. Elytra truncated. Tarsi with entire joints.

272. PAUSSUS. GENUS CCLXXII. PAUSSUS. Linnæus, Fabricius, Thunberg, Herbst, Afzelius, Donovan, Latreille.
Antennæ two-jointed, the last very large and irregular.

Microcephalus. *Sp.* 1. *Microcephalus.*
Paussus microcephalus. Linnæus, Thunberg, Herbst, Latreille, Afzelius, Fabricius.
Inhabits Africa.

273. CERAPTERUS. GENUS CCLXXIII. CERAPTERUS. Swederus, Donovan, Latreille.
Antennæ ten-jointed, perfoliated.

Macleaii. *Sp.* 1. *Macleaii.*
Cerapterus macleaii. Donovan, Latreille.
Inhabits New Holland.

TRIBE V. MYCETOPHAGIDES.

Body ovoid or oblong; in some depressed, in others linear. Palpi filiform or bent at their extremities. Antennæ ten or eleven jointed, thickening towards their extremities, or terminated by a perfoliated mass.

FAMILY I. *Nemosomida.*

Antennæ ten-jointed.

DIVISION I.

Antennæ with the club three-jointed, perfoliated.

274. CIS. GENUS CCLXXIV. CIS. Latreille.
ANOBIUM. Fabricius, Illiger, Herbst, Paykull.
DERMESTES. Scopoli.
HYLESINUS. Fabricius.
PTINUS. Marsham.
Antennæ twice as long as the head. Body oval, depressed.

Boleti. *Sp.* 1. *Boleti.*
Dermestes boleti. Scopoli.
Anobium boleti. Fabricius, Illiger, Paykull.
Anobium bidentatum. Olivier.
Ptinus boleti. Marsham.
Inhabits the *Boletus vesicolor.*

275. NEMOSOMA. GENUS CCLXXV. NEMOSOMA. Latreille.
DERMESTES. Linnæus.
IPS. Olivier.
COLYDIUM. Hellwig, Herbst.
Antennæ not or scarcely longer than the head. Body linear. Head as long, or nearly as long, as the thorax.

Elongatum. *Sp.* 1. *Elongatum.*
Nemosoma elongatum. Latreille.
Ips elongatus. Olivier.
Colydium fasciatum. Hellwig, Herbst.
Inhabits Europe.

DIVISION II.

Antennæ with a nearly globose two-jointed club.

276. Cer lon. GENUS CCLXXVI. CERYLON. Latreille.
RYZOPHAGUS. Herbst.
LYCTUS. Fabricius, Panzer, Paykull.
Body elongate. Thorax quadrate, with the hinder margin straight, contiguous with the elytra. Abdomen not pedunculated.

Histeroid *Sp.* 1. *Histeroides.*
Lyctus histeroides. Fabricius, Paykull, Panzer.
Ryzophagus histeroides. Herbst.
Cerylon histeroides. Latreille.
Inhabits Europe, beneath the bark of trees.

277. MONOTOMA. GENUS CCLXXVII. MONOTOMA. Herbst.
CERYLON. Latreille.
LYCTUS. Fabricius, Paykull, Panzer.
Body elongate, linear. Thorax quadrate, with the hinder margin distant from the base of the elytra. Abdomen somewhat pedunculated.

Terebra *Sp.* 1. *Terebrans.*
Cerylon terebrans. Latreille.
Inhabits beneath the bark of trees.

Juglandi *Sp.* 2. *Juglandis.*
Lyctus juglandis. Fabricius, Paykull, Panzer.
Corticaria taxicornis. Marsham.
Inhabits beneath the bark of trees.

FAMILY II. *Mycetophagida.*

Antennæ eleven jointed. Mandibles little or not at all prominent.

DIVISION I.

Antennæ with the club two-jointed.

278. Di ma. GENUS CCLXXVIII. DITOMA. Latr.
BITOMA. Herbst.
LYCTUS. Fabr. Payk.
IPS. Olivier.

Crenata. *Sp.* 1. *Crenata.*
Bitoma crenata. Herbst.
Ditoma crenata. Latr.
Lyctus crenatus. Fabr. Payk.
Ips crenatus. Olivier.
Inhabits Europe under the bark of dead trees.

DIVISION II.

Antennæ gradually thickening towards their extremities. Tarsi with the first joint longer than the following one.

279. M topha. GENUS CCLXXIX. MYCETOPHAGUS. Fabricius, Paykull, Oliv. Panzer, Latr.
TRITOMA. Geoff.
DERMESTES. Thunberg.
SILPHOIDES. Herbst.
BOLETARIA. Marsh.
Body oval. Antennæ with the last joint elongate, ovate. Maxillary palpi prominent.

Quadr tulatu *Sp.* 1. *Quadripustulatus.*
Mycetophagus quadripustulatus. Fabricius, Latreille, Panzer, Paykull.
Boletaria quadripustulata. Marsham.
Inhabits fungi.

DIVISION III.

Antennæ gradually thickening towards their extremities, or with a three-jointed club.

Subdivision 1.

Tarsi with the first joint not longer than the following one. Palpi very short; the maxillary ones not, or but little, prominent. Antennæ with an abrupt club of three joints, not longer than the head. Body elongate, linear.

GENUS CCLXXX. COLYDIUM. Latr. Fabr. Herbst, Paykull.

TRITOMA. Thunberg.

IPS. Olivier, Rossi.

Sp. 1. *Elongatum.*

Colydium elongatum. Fabr. Herbst, Paykull, Latr.

Ips elongatus. Olivier.

Ips linearis. Rossi.

Inhabits Europe under the bark of trees.

Subdivision 2.

Tarsi with the first joint longer than the second. Palpi very short, the maxillary ones but little or not at all prominent. Antennæ as long as the thorax or less.

GENUS CCLXXXI. LATRIDIUS.* Herbst.

IPS. Olivier.

CORTICARIA. Marsham.

DERMESTES. Fabricius, Paykull.

Antennæ with the second joint larger than the third.

Sp. 1. *Porcatus.*

Latridius porcatus. Herbst.

Latridius minutus. Latreille.

Dermestes marginatus. Paykull.

Inhabits houses in Europe.

GENUS CCLXXXII. SILVANUS. Latreille.

TENEBRIO. De Geer.

DERMESTES. Fabricius, Panzer.

IPS. Olivier.

Colydium. Paykull, Herbst.

Corticaria. Marsham.

Antennæ with the second and following joints to the eighth joint nearly equal.

Sp. 1. *Unidentatus.*

Silvanus unidentatus. Latreille.

Dermestes unidentatus. Fabricius.

Ips unidentatus. Olivier.

Colydium unidentatum. Paykull.

Colydium planum. Herbst.

Inhabits Europe under the bark of trees.

Sp. 2. *Frumentarius.*

Colydium frumentarium. Panzer.

Corticaria frumentaria. Marsham.

Silvanus frumentarius. Latreille.

Inhabits Europe.

Subdivision 2.

Tarsi with the first joint not longer than the following joint. Maxillary palpi prominent. Body elongate, narrow. Antennæ with the three last joints rather thicker.

GENUS CCLXXXIII. MERYX. Latreille.

Thorax almost cordiform. Eyes rather prominent. Palpi clavate, the last joint sub-obtrigonate, larger than the rest.

Sp. 1. *Rugosa.*

Meryx rugosa. Latr. *Gen. Crust. et Ins.* xi. fig. 1.

Inhabits the East Indies.

DIVISION IV.

Antennæ eleven-jointed. Mandibles prominent or exserted.

Subdivision 1.

Mandibles small. Body long and linear.

GENUS CCLXXXIV. LYCTUS. Fabricius, Paykull. 284. LYCTUS.

IPS. Olivier.

BITOMA. Herbst.

CORTICARIA. Marsham.

Antennæ with a two-jointed club. Thorax long and linear.

Sp. 1. *Oblongus.* Oblongus.

Lyctus oblongus. Latreille.

Lyctus canaliculatus. Fabricius.

Ips oblongus. Olivier.

Bitoma unipunctata. Herbst.

Corticaria oblonga. Marsham.

Inhabits Europe in old wood.

Subdivision 2.

Mandibles large. Body elongate, much depressed, nearly equally broad.

GENUS CCLXXXV. TROGOSITA. Fabricius, Olivier, Illiger, Latreille, Lamarck. 285. TROGOSITA.

TENEBRIO. Linnæus, Marsham, Rossi.

PLATYCERUS. Geoffroy.

Thorax almost quadrate, separated from the abdomen by a remarkable interval. Antennæ moniliform, shorter than the thorax, compressed towards the apex. Labrum excerted, coriaceous, small, hairy in front.

Sp. 1. *Mauritanica.* Mauritanica.

Tenebrio mauritanicus. Linnæus? Rossi, Marsham.

Trogosita caraboides. Fabricius, Illiger, Paykull, Herbst, Latreille.

Trogosita mauritanica. Olivier.

Inhabits Europe. Dr Leach has seen it alive in a box of insects brought from Pará in the Brasils.

TRIBE VI. CUCUJIDES.

Body oblong and much depressed. Head not globose. Palpi filiform or thicker towards their extremities. Antennæ of the same thickness throughout, all eleven-jointed. Thorax almost quadrate, generally dentated or angulated.

DIVISION I.

Antennæ moniliform, shorter than the body.

GENUS CCLXXXVI. PARANDRA. Latreille. 286. PARANDRA.

ISOCERUS. Illiger.

ATTELABUS. De Geer.

TENEBRIO. Fabricius, Herbst.

Labrum very small. Palpi terminated by an oval joint. Tarsi long. Thorax quadrate, marginate.

Sp. 1. *Lævis.* Lævis.

Parandra lævis. Latreille.

Attelabus lævus. De Geer.

Tenebrio brunneus. Fabricius.

Tenebrio purpurascens. Herbst.

Inhabits America.

GENUS CCLXXXVII. CUCUJUS. Fabricius, Olivier, Paykull. 287. CUCUJUS.

CANTHARIS. Linnæus?

Labrum porrect, very apparent. Palpi with their last joint obconic, truncate. Tarsi short. Lip bifid.

Sp. 1. *Depressus.* Depressus.

Cucujus depressus. Paykull, Olivier, Latreille, Fabricius.

Cantharis sanguinolenta. Linnæus?

Inhabits Sweden and Germany.

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* The genus *Dacycerus* of Brongniart is akin to this genus.

DIVISION II.

Antennæ as long as the body, often longer, composed of elongate cylindric joints.

288. Uleiota. GENUS CCLXXXVIII. ULEIOTA. Latreille.
CERAMBYX. Linnæus.
BRONTES. Fabricius.
CUCUJUS. Olivier, Herbst.

Labrum porrect, very apparent. Palpi terminated by an almost conic pointed joint. Tarsi short.

Flavipes. *Sp.* 1. *Flavipes.*
Cerambyx planatus. Linnæus.
Uleiota flavapes. Latreille.
Brontes flavipes. Fabricius.
Cucujus planatus. Herbst.
Cucujus flavipes. Olivier, Paykull.
Inhabits Europe, beneath the bark of dead trees.

DIVISION III.

Head not gradually produced into a restrum. Tarsi strong beneath.

Subdivision 1.

Antennæ filiform or setaceous, or slightly thickening towards their extremities. Maxillæ with no horny hook on their internal sides.

TRIBE VII. CERAMBYCIDES.

Lip much widened at its extremity, cordiform. Body elongate. Antennæ long, generally inserted in a nitch in the eyes.

FAMILY I. *Prionida.*

Labrum very small, or almost none.

DIVISION I.

Antennæ moniliform, short.

289. Spondylis. GENUS CCLXXXIX. SPONDYLIS. Fabricius, Olivier, Latreille.
ATTELABUS. Linn.
CERAMBYX. De Geer.

Palpi with the last joint nearly obconic. Body convex. Tarsi with the penultimate joint distinctly bifid. Thorax almost orbicular, without border or teeth.

Buprestoides. *Sp.* 1. *Buprestoides.*
Spondylus buprestoides. Fabr. Oliv. Latr.
Attelabus buprestoides. Linn.
Inhabits Europe, at the roots of the pine.

DIVISION II.

Antennæ pectinated or serrated, in all longer than the thorax.

290. Prionus. GENUS CCXC. PRIONUS. Geoffroy, Fabricius, Olivier, Latreille.
CERAMBYX. Linn. Marsham.

Thorax with the sides gently sloping, dentated. Antennæ serrated, a little shorter than the body; of the male twelve, of the female eleven-jointed.

Coriarius. *Sp.* 1. *Coriarius.*
Cerambyx coriarius. Linn.
Prionus coriarius. Latreille, Fabricius, Olivier.
Inhabits Europe.

FAMILY II. *Cerambycida.*

Labrum very apparent, of various sizes. Antennæ inserted in a nitch in the eyes.

DIVISION I.

Head vertical. Palpi almost filiform.

GENUS CCXCI. MACROPUS. Thunberg. 291. Macropus.
PRIONUS. Olivier.
CERAMBYX. Linn.
LAMIA. Latreille.

Body much depressed. Thorax with a moveable spine on each side, placed on a tubercle. Anterior feet of the male very long.

Sp. 1. *Longimanus.* Longimanus.
Prionus longimanus. Olivier.
Lamia longimana. Latr.
Cerambyx longimanus. Linn.
Inhabits Brasil.

GENUS CCXCII. LAMIA. Leach. 292. Lamia.
LAMIA. Latreille, Fabricius.
CERAMBYX. Linn. Marsham, Fabricius.

Antennæ ten-jointed, longer than the body.

This genus is divided into sections.

A. Body depressed. (LAMIA, Fabricius.)

Sp. 1. *Ædilis.* Ædilis.
Lamia ædilis. Fabricius, Latreille.
Cerambyx ædilis. Linn. Marsham.
Inhabits Europe.

B. Body not depressed. (LAMIA, CERAMBYX, Fabricius.)

Sp. 2. *Nebulosus.* Nebul
Cerambyx nebulosus. Fabricius, Marsham.
Lamia nebulosa. Latreille.
Inhabits Europe.

Sp. 3. *Textor.* Text
Lamia textor. Fabricius, Latreille.
Inhabits Europe.

C. Body linear. Thorax not spined at the sides. (SAPERDA, Fabricius.)

Sp. 4. *Oculata.* Oculat
Cerambyx oculatus. Marsham.
Saperda oculata. Fabricius.
Lamia oculata. Latreille.
Inhabits Europe.

GENUS CCXCIII. SAPERDA. Leach. 293. S
CERAMBYX. Marsham.

Antennæ eleven-jointed, longer than the body. Body linear. Thorax without spines.

Sp. 1. *Lineato-collis.* Lineato-collis
Cerambyx lineato-collis. Marsham.
Saperda lineato-collis. Leach, *Zoolog. Mis.* vol. i.
Inhabits England.

DIVISION II.

Head nutant. Palpi with the last joint thicker than the others.

GENUS CCXCIV. CERAMBYX. Linn. Fabricius, Latreille, &c. 294.
STENOCORUS. Fabricius.

Antennæ longer than the body. Palpi with the last joint obconic, compressed. Thorax with a spine on each side.

Sp. 1. *Moschatus.* (Musk cerambyx.) Mos
Cerambyx moschatus. Lin. Fabricius, Latreille, &c.
Inhabits willows in Europe, emitting, whilst alive, a fine smell, resembling the flavour of roses.

GENUS CCXCV. STENOCORUS. Fabricius. 295.
CERAMBYX. Latreille.

Palpi with the last joint obtrigonate. Thorax without spines.

Sp. 1. *Spinicornis.* Spi
Stenocorus spinicornis. Fabricius.
Cerambyx spinicornis, Latreille.

GENUS CCXCVI. CLYTUS. Fabricius. 296.
CERAMBYX. Linn.

Metabolia.

Callidium. Latreille.

Labial palpi with the last joint obtrigonate. Thorax without spines, globose. Antennæ shorter than the body. Hinder thighs clavate.

Arietis. *Sp.* 1. *Arietis.*

Cerambyx arietis. Linn.

Clytus arietis. Fabricius.

Callidium arietis. Latreille.

Inhabits Europe.

297. Callidium. **Genus CCXCVII Callidium.** Fabricius, Latreille.

Cerambyx. Linn. Marsham.

Labial palpi with the last joint obtrigonate. Thorax orbicular, depressed, or but little convex. Antennæ setaceous, as long as the body. Hinder thighs abruptly clavate.

Violaceum. *Sp.* 1. *Violaceum.*

Cerambyx violaceus. Linn. Marsh.

Callidium violaceum. Fabricius, Latreille.

Inhabits Europe.

29. Necydalis. **Genus CCXCVIII. Necydalis.** Linn. De Geer, Fabricius.

Leptura. Geoffroy.

Molorchus. Fabricius.

Elytra subulated, not entirely covering the wings and abdomen.

Rufa. *Sp.* 1. *Rufa.*

Necydalis rufa. Fabr. Latr.

Inhabits Europe.

99 Molorchus. **Genus CCXCIX. Molorchus.** Fabricius.

Necydalis. Linn. Marsham, Latreille.

Elytra abbreviated.

Major. *Sp.* 1. *Major.*

Necydalis major. Linn.

Molorchus umbellaturum. Fabr.

Inhabits Europe.

Family III. *Lepturida.*

Labrum very apparent. Antennæ inserted between the eyes.

0 Leptura. **Genus CCC. Leptura,** of authors.

Thorax not spined on each side.

longata. *Sp.* 1. *Elongata.*

Leptura elongata. Fabricius, Latreille, Marsham.

Inhabits Europe.

1. Rhagium. **Genus CCCI. Rhagium.** Fabricius.

Leptura. Latreille, Marsham.

Thorax with a spine on each side.

quisitor. *Sp.* 1. *Inquisitor.*

Leptura inquisitor. Latr. Marsh.

Rhagium inquisitor. Fabricius.

Inhabits Europe.

Tribe VIII. Crioceridæ.

Lip not cordiform. Maxillæ with their external division not resembling a two-jointed palpus. Body elongate. Thorax cylindric or quadrate.

Family I. *Sagrida.*

Mandibles with their extremities not notched.

Megalopus. **Genus CCCII. Megalopus.** Fabricius, Latreille.

Antipus? De Geer.

Antennæ almost serrated, inserted at the internal margin of the eyes, shorter than the thorax. Palpi filiform, terminated by an elongate, very pointed, and conic joint. Thorax almost quadrate. Body little lengthened.

icornis. *Sp.* 1. *Nigricornis.*

Megalopus nigricornis. Fabricius, Latreille. *Gen. Crust. et Ins.* 3. tab. 11. fig. 5.

Inhabits South America.

303. Orsodachna. **Genus CCCIII. Orsodachna.** Latreille.

Crioceris. Geoffroy, Fabricius, Paykull, Panzer.

Antennæ simple, inserted before the eyes, as long as the thorax or less. Maxillary palpi thick and truncate at their extremities. Body long. Thorax elongate. Eyes globose.

Cerasi. *Sp.* 1. *Cerasi.*

Crioceris cerasi. Fabricius.

Orsodachna chlorotica. Latreille.

Inhabits Sweden, Germany, and France.

304. Sagra. **Genus CCCIV. Sagra.** Fabricius, Latreille, Herbst.

Alurnus. Olivier.

Tenebrio. Sulzer.

Antennæ simple, inserted before the eyes. Palpi filiform, the last joint somewhat ovate, the apex acute. Eyes lunate. Hinder feet, especially the thighs, very thick. Body elongate.

Femorata. *Sp.* 1. *Femorata.*

Sagra femorata. Herbst, Fabr. Latr.

Alurnus femoratus. Olivier.

Inhabits Africa.

Family II. *Criocerida.*

Mandibles bifid or notched at their extremities.

305. Donacia. **Genus CCCV. Donacia.** Fabr. Payk. Hoppe, Oliv. Latr.

Leptura. Linn. Marsh.

Antennæ with elongate cylindric joints, those of the base obconic. Eyes not notched. Abdomen elongate-triangular. Hinder thighs thick.

* Hinder thighs dentated.

Micans. *Sp.* 1. *Micans.*

Donacia micans. Hoppe.

Leptura micans. Marsh.

Inhabits Europe.

** Hinder thighs simple.

Simplex. *Sp.* 2. *Simplex.*

Leptura simplex. Marsham.

Inhabits Europe.

306. Crioceris. **Genus CCCVI. Crioceris.** Geoff. Oliv. Lamarck.

Chrysomela. Linn. De Geer.

Lema. Fabricius.

Auchenia. Marsham.

Antennæ moniliform, with the exception of the basal joints which are globose. Eyes notched. Neck distinct. Abdomen quadrate.

Merdigera. *Sp.* 1. *Merdigera.*

Crioceris merdigera. Latreille.

Lema merdigera. Fabricius.

Auchenia merdigera. Marsham.

Chrysomela merdigera. Linn.

Inhabits the white lily.

Tribe IX. Chrysomelides.

Lip not cordiform. Maxillæ with their external division resembling a biarticulate palpus. Body more or less ovoid or oval. Thorax transverse, or not longer than broad.

Family I. *Cassidida.*

Palpi very small. Antennæ inserted near each other between the eyes, at a distance from the mouth.

Division I.

Body elongate. Thorax almost quadrate.

307. Alurnus. **Genus CCCVII. Alurnus.** Fabricius, Latreille.

Hispa. Olivier.

Body not spinose. Mandibles terminated by a strong hook.

Grossus. *Sp.* 1. *Grossus.*

Alurnus grossus. Fabricius, Latreille.

308. Hispa. Genus CCCVIII. Hispa. Linn. Fabricius, Olivier.

Crioceris. Olivier.

Body spinose. Mandibles with their points bidentate.

Atra. *Sp.* 1. *Atra.*

Hispa atra. Linn. Fabricius, Olivier, Panzer.

Inhabits Europe. This species has been introduced into the British *Fauna* on dubious authority.

Division II.

Thorax semicircular. Body shield-shaped.

309. Himatidium. Genus CCCIX. Himatidium. Illiger.

Imatidium. Fabricius, Latreille.

Antennæ entirely exserted, cylindric. Body nearly quadrate.

Leayanum. *Sp.* 1. *Leayanum.*

Imatidium leayanum. Latreille.

310. Cassida. Genus CCCX. Cassida. Linn. Fabr. Latr. &c.

Antennæ thicker towards their extremities, their base concealed by the thorax. Body nearly orbiculate.

Equestris. *Sp.* 1. *Equestris.*

Cassida equestris. Fabr. Payk. Panz. Latr.

Cassida viridis. Marsham, Illiger.

Inhabits *Mentha sylvestris.*

Family II. *Galerucidæ.*

Maxillary palpi very apparent. Antennæ inserted very near to each other, between the eyes, towards the middle of the face.

Division I.

Feet not formed for leaping.

311. Adorium. Genus CCCXI. Adorium. Fabricius, Latreille.

Oides. Weber.

Palpi with the last joint but one dilated, the last short, nearly cylindric, truncate. Antennæ almost orbicular. Elytra with their exterior margin arcuated.

Bipunctatum. *Sp.* 1. *Bipunctatum.*

Adorium bipunctatum. Fabricius, Latreille.

Oides bipunctata. Weber.

Inhabits Eastern India.

312. Galeruca. Genus CCCXII. Galeruca. Geoff. Latr. Fabr. Oliv.

Chrysomela. Linn. De Geer, Marsham.

Palpi with the two last joints very slightly different in size, the last conic. Antennæ shorter than the body, the joints obconic, the second joint half the length of the third.

Tanaceti. *Sp.* 1. *Tanaceti.*

Chrysomela tanaceti. Marsham.

Galeruca tanaceti. Latreille, Fabricius.

Inhabits Europe.

313. Adimonia. Genus CCCXIII. Adimonia. Schrank.

Galeruca. Latreille, Fabricius.

Crioceris. Fabricius.

Palpi with the two last joints not very different in size, the last joint conic. Antennæ shorter than the body, the joint obconic, with the second and third joints shorter than the fourth joint.

Nigricornis. *Sp.* 1. *Nigricornis.*

Crioceris nigricornis. Fabricius.

Galeruca nigricornis. Latreille.

Inhabits Europe.

Alni. *Sp.* 2. *Alni.*

Chrysomela alni. Marsham.

Galeruca alni. Latreille, Fabricius.

Inhabits Europe.

Genus CCCXIV. Luperus. Geoff. Oliv. Latr.

Crioceris. Fabricius.

Palpi with the two last joints nearly equal in size, the last conic. Antennæ as long as the body, the joint cylindric, elongate.

Sp. 1. *Flavipes.* Flavipes.

Luperus flavipes. Latreille.

Crioceris flavipes. Fabricius.

Inhabits Europe.

Sp. 2. *Rufipes.* Rufipes.

Crioceris rufipes. Fabricius.

Inhabits Europe.

Division II.

Hinder feet formed for leaping, the thighs being incrassated.

Genus CCCXV. Haltica.

Altica. Geoffroy, Olivier, Panzer, Latreille.

Chrysomela. Linn. De Geer, Marsham.

Crioceris. Fabricius.

Lema. Fabricius.

Galeruca. Fabricius.

Antennæ with the second joint generally a little shorter than the second.

* Body ovate.

Sp. 1. *Oleracea.* Oleracea

Altica oleracea. Latreille, Panzer.

Gallernea oleracea. Fabricius.

Inhabits Europe.

** Body nearly orbiculate.

Sp. 2. *Testacea.* Testacea

Galeruca testacea. Fabricius.

Altica testacea. Latreille.

Inhabits Europe.

Family III. *Chrysomelidæ.*

Maxillary palpi very apparent. Antennæ inserted before the eyes, gradually thickening towards their points. Head nutant, forming an obtuse angle with the thorax.

Division I.

Mandibles short, obtuse, truncated, or terminated by a very short point. Antennæ with the four last joints globose or turbinated.

Subdivision 1.

Antennæ with the four last joints turbinated. Body hemispheric or oval. Thorax transverse.

Genus CCCXVI. Paropsis. Olivier, Latreille.

Notoclea. Marsham.

Maxillary palpi terminated by a securiform joint. Body hemispherical.

Sp. 1. *Australasiæ.*

Paropsis Australasiæ. Olivier.

Inhabits New Holland.

Genus CCCXVII. Doryphora. Oliv. Latr. Illiger.

Chrysomela. Fabricius.

Maxillary palpi terminated by a transverse joint shorter than the one before it. Sternum with its middle produced into a horn.

Sp. 1. *Punctatissima.*

Chrysomela punctatissima. Fabricius.

Doryphora punctatissima. Illiger, Latreille.

Genus CCCXVIII. Chrysomela. Latr. Fabr. Oliv.

Metabolia. Palpi terminated by two joints of nearly an equal length, the last almost ovoid truncate, or nearly cylindric. Sternum not produced.

* Thorax with the sides incrassated, as if margined: Body ovate-quadrate.

Banksii. *Sp.* 1. ***Banksii.***
Chrysomela Banksii. Fabricius, Latreille, Marsham.
Inhabits Europe.

** Thorax with the sides not incrassated. Body ovate quadrate.

Litura. *Sp.* 2. *Litura.*
Chrysomela litura. Fabricius, Latreille, Marsham.
Inhabits the broom.

** Body elongate-ovate-quadrate.

Marginella. *Sp.* 3. *Marginella.*
Chrysomela marginella. Fabricius, Latreille.
Inhabits Europe.

Subdivision 2.

Antennæ with the four last joints semi-globose almost forming a club. Body elongate-quadrate. Thorax as long as broad.

GENUS CCCXIX. HELODES. Paykull, Fabricius, Olivier.
PRASOCURIS. Latreille.
CHRYSOMELA. Marsham, Hellwig.
Palpi short, thicker at their middle, the last joint short-obconic.

Sp. 1. ***Phellandrii.***
Helodes phellandrii. Paykull, Fabricius.
Prosocuris phellandrii. Latreille.
Inhabits Europe.

Sp. 2. ***Violacea.***
Helodes violacea. Fabricius.
Chrysomela beccabungæ. Hellwig, Marsham.
Inhabits Europe.

DIVISION II.

Mandibles abruptly arcuated, terminated by a very strong point. Antennæ with the four last joints elongate, compressed, reversed-conic, the last long almost elliptic, and terminated by a point resembling an additional joint.

GENUS CCCXX. COLASPIS. Fabricius, Latreille.
Maxillary palpi terminated by a large joint, nearly ovoid.

Sp. 1. ***Surinamensis.***
Colaspis Surinamensis. Latreille.
Inhabits Surinam.

FAMILY IV. *Cryptocephalida.*

Maxillary palpi very apparent. Antennæ inserted before the eyes. Head vertical.

DIVISION I.

Palpi with the last joint thick, ovoid. Body nearly ovoid.

GENUS CCCXXI. EUMOLPUS. Kugellan, Weber, Fabricius, Latreille.
CRYPTOCEPHALUS. Olivier, Geoffroy.
Thorax with a very convex back, which is gibbose.

Sp. 1. ***Vitis.***
Cryptocephalus vitis. Fabricius.
Eumolpus vitis. Fabricius, Latreille.
Inhabits Europe on the vine.

DIVISION II.

Palpi with the last joint conic-cylindric. Body short-cylindric.

GENUS CCCXXII. CRYPTOCEPHALUS. Geoffroy, Fabricius, Olivier, Latreille, Lamarck, Marsham. Metabolia. 322. Cryptocephalus.
CHRYSOMELA. Linn. De Geer.
Antennæ simple, filiform, about the length of the body.

Sp. 1. *Sericeus.* Sericeus.
Chrysomela sericea. Linn.
Cryptocephalus sericeus. Fabricius, Olivier, Marsh.
Inhabits the flowers of the Dandelion.

GENUS CCCXXIII. CLYTHRA. Laicharting, Fabricius, Olivier, Latreille. 323. Clythra.
CHRYSOMELA. Linn.
MELOLONTHA. Geoffroy.
CRYPTOCEPHALUS. Marsham.
Antennæ short, serrated, exserted. Palpi alike.

Sp. 1. *Quadripunctata.* Quadripunctata.
Clythra quadripunctata. Fabricius, Latreille.
Cryptocephalus quadripunctatus. Marsham.
Chrysomela quadripunctata. Linn.
Inhabits Europe.

GENUS CCCXXIV. CLAMYS. Knoch, Latreille. 324. Clamys.
CLYTHRA. Fabricius, Olivier.
Labial palpi furcate. Feet contractile. Antennæ short, serrated, lodged in a rim of the thorax.

Sp. 1. *Monstrosa.* Monstrosa.
Clythra monstrosa. Fabricius.
Chlamys monstrosa. Latreille.

Subdivision 1.

Antennæ a perfoliated club. Maxillæ with their internal side unguiculated.

TRIBE X. EROTYLIDES.

FAMILY I. *Erotylida.*

Palpi all terminated by large, semilunar, or securiform joints.

DIVISION I.

Antennæ with their intermediate joints elongate, nearly cylindric or obconic. Body much elevated. Thorax flat. Tibiæ slender, nearly cylindric.

GENUS CCCXXV. EROTYLUS. Fabr. Oliv. Latr. 325. Erotylus.
Body ovate or oval.

Sp. 1. *Gibbosus.* Gibbosus.
Erotylus gibbosus. Fabricius, Latreille.

GENUS CCCXXVI. ÆGITHUS. Fabricius. 326. Ægithus.
EROTYLUS. Latreille.
Body hemispheric.

DIVISION II.

Antennæ moniliform below, terminated by an ovoid club. Thorax elevated at the middle. Tibiæ elongate-triangular.

GENUS CCCXXVII. TRITOMA. Fabr. Oliv. Latr. 327. Tritoma.
Body short-ovate, the back elevated in the middle. Thorax with the middle of the hinder margin dilated into an angle.

Sp. 1. *Bipustulatum.* Bipustulatum.
Tritoma bipustulatum. Fabricius, Paykull, Latreille.
Inhabits Boleti.

GENUS CCCXXVIII. TRIPLAX. Payk. Fabr. Oliv. 328. Triplax.
SILPHA. Linn. Marsham.
Body oval.

Sp. 1. *Russica.* Russica.
Silpha russica. Linn. Marsham.
Triplax russica. Paykull, Fabricius.
Tritoma russica. Latreille.
Inhabits dead trees and fungi.

Metabolia.

FAMILY II. *Phalacrurida.*

Maxillary palpi filiform, or thicker towards their extremities.

DIVISION I.

Tarsi with the penultimate joint, bilobate. Body not contractile into a ball.

Subdivision 1.

Body linear.
329. LANGURIA. GENUS CCCXXIX. LANGURIA. Latreille.
TROGOSITA. Fabricius.
Antennæ with a five-jointed club.
Bicolor. *Sp.* 1. *Bicolor.*
Languria bicolor. Latreille.
Trogosita bicolor. Fabricius.
Inhabits North America.

Subdivision 2.

Body hemispheric.
330. PHALACRUS. GENUS CCCXXX. PHALACRUS. Latreille, Paykull.
SPHÆRIDIUM. Fabricius.
DERMESTES. Scopoli, Marsham.
ANISOTOMA. Illiger, Fabricius.
VOLVOXIS. Kugellan.
Antennæ with a three-jointed club.
Bicolor. *Sp.* 1. *Bicolor.*
Phalacrus bicolor. Paykull, Latreille.
Dermestes calthæ. Scopoli.
Anisotoma bicolor. Illiger Fabricius.
Inhabits flowers in Europe.

DIVISION II.*

Tarsi with the joints entire. Body nearly globose, contractable into a ball.
331. AGATHIDIUM. GENUS CCCXXXI. AGATHIDIUM. Illiger, Latr.
ANISOTOMA. Fabricius.
SPHÆRIDIUM. Olivier.
VOLVOXIS. Kugellan.
Antennæ with a three-jointed club.
Nigripenne. *Sp.* 1. *Nigripenne.*
Agathidium nigripenne. Illiger, Latreille.
Sphæridium ruficolle. Olivier.
Anisotoma nigripennis. Fabricius.
Inhabits Europe.

SECTION IV. TRIMERA.

Tarsi all three-jointed.

TRIBE I. COCCINELLIDES.

Antennæ shorter than the thorax. Maxillary palpi terminated by a very large securiform joint. Body hemispheric. Thorax transverse, the hinder margin arcuated.
332. SCYMNUS. GENUS CCCXXXII. SCYMNUS. Herbst, Kugellan.
COCCINELLA. Latr. Fabr.
Thorax scarcely narrower than the elytra, the lateral and external margins meeting together. Body ovate, pubescent.
Biverrucata. *Sp.* 1. *Biverrucata.*
Coccinella biverrucata. Fabr.
Inhabits Europe.
333. COCCINELLA. GENUS CCCXXXIII. COCCINELLA.† Linn. Fabr. Latr. &c.
Metabolia.
Thorax (even behind) narrower than the elytra. Body hemispheric, approaching to ovate.
Septempunctata. *Sp.* 1. *Septempunctata,* (common *Lady-cow*).
Coccinella septempunctata. Linn. Fabr. &c.
Inhabits Europe.
334. CHILOCORUS. GENUS CCCXXXIV. CHILOCORUS. Leach's MSS.
COCCINELLA. Fabr. Latr. Marsh.
Thorax lunate, without hinder angles. Body entirely marginated.
Cacti. *Sp.* 1. *Cacti.*
Coccinella cacti. Fabr. Latr.
Chilocorus cacti. Leach's MSS.
Inhabits Europe.

TRIBE II. ENDOMYCHIDES.

Antennæ longer than the thorax. Maxillary palpi not terminated by a large joint. Body more or less ovoid. Thorax almost quadrate.
335. EUMORPHUS. GENUS CCCXXXV. EUMORPHUS. Weber, Latr. Fabr.
Antennæ with the third joint very long. Maxillary palpi filiform. Labial palpi with the two last joints an obtrigonate head.
Kirbyanu *Sp.* 1. *Kirbyanus.*
Eumorphus Kirbianus. Latr. *Gen. Crust. et Ins.* iii. 72.
Eumorphus immarginatus. Latr. *Gen. Crust. et Ins.* Tab. xi. fig. 12.
Inhabits eastern India.
336. EN-DOMYCH GENUS CCCXXXVI. ENDOMYCHUS. Payk. Fabr.
CHRYSOMELA. Linn. De Geer.
TENEBRIO. Marsh.
Antennæ with the greater portion of their joints very short, nearly cylindric; the ninth longer than the one before it; the last with the apex truncate or obtuse. Palpi with their extremities thicker. Thighs not abruptly clavate. Body ovate. Thorax short, with the base gradually enlarging from the apex, not narrowed behind. Mandibles with their points distinctly bifid or bidentate.
Coccine *Sp.* 1. *Coccineus.*
Chrysomela coccinea. Linn.
Endomychus coccineus. Payk. Latr. Fabr.
Tenebrio coccineus. Marsh.
Inhabits Europe.
337. LY-COPERD GENUS CCCXXXVII. LYCOPERDINA. Latr.
ENDOMYCHUS. Fabr. Payk. Oliv.
TENEBRIO. Marsh.
Antennæ moniliform, gradually thickening towards their extremities, the ninth joint scarcely longer than the one before it. Maxillary palpi filiform. Labial palpi with the last joint large, almost ovoid. Thighs abruptly clavate. Body elongate-ovate. Thorax with the anterior angles a little dilated, narrowed behind. Mandibles with their points very acute, undivided.
Bovista *Sp.* 1. *Bovistæ.*
Endomychus bovistæ. Payk. Fabr.
Tenebrio bovistæ. Marsh.
Lycoperdina immaculata. Latr.
Inhabits Europe.

SECT. V. DIMERA.

Tarsi with two joints.

TRIBE I. PSELAPHIDES.

Elytra short. Antennæ eleven-jointed. Mandibles in all.

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* The genus *Clypeaster* of Andersch has nine joints in its antennæ, and a clypeiform thorax shielding the head.

† The British species are to form the subject of a paper for the Linnæan Society, by Mr Stephens, an acute entomologist.

338. Pselaphus. GENUS CCCXXXVIII. PSELAPHUS. Herbst, Paykull, Illiger, Latreille, Panzer.

ANTHICUS. Fabr.

Antennæ with the two or three last joints larger than the rest, the extreme joint ovoid. Labial palpi much shorter than the maxillary ones, the last joint very long, cylindric. Maxillary palpi much porrected. Tarsi with one nail.

Impressus. *Sp.* 1. *Impressus.*

Pselaphus impressus. Panzer, Latr.

Inhabits Europe. It sometimes occurs in Battersea fields amongst the roots of grass.

339. Chennium. GENUS CCCXXXIX. CHENNIUM. Latr.

Antennæ with the ten first joints nearly equal, lenticular; the last largest, semiglobose. Palpi very small, not exserted. Tarsi with two nails.

Bituberculatum. *Sp.* 1. *Bituberculatum.*

Chennium bituberculatum. Latr.

Inhabits France.

TRIBE II. CLAVIGERIDES.

Elytra short. Antennæ six-jointed. Mandibles none.

340. Claviger. GENUS CCCXL. CLAVIGER. Preysler, Illiger, Latreille.

Antennæ with the middle joints semiglobose, the last larger, short-cylindric. Palpi very small. Tarsi with one nail.

ORDER IV. STREPSIPTERA.

ORDER STREPSIPTERA. Kirby.

ORDER HYMENOPTERA. Rossi.

We are indebted to Rossi for the discovery of the type of this highly interesting order of insects. The insect discovered by this author was denominated *Xenops Vesparum,* and was by him, without hesitation or comment, assigned a place among the hymenopterous insects, next to *Ichneumon.* The Rev. William Kirby, who first called the attention of entomologists to a British insect named *Stylops Melittæ,* was the first author who observed that it possessed characters different from those of any of the established orders of insects; and this opinion has been since confirmed by Mons. Latreille, who, in the end of his *Genera Crustaceorum et Insectorum,* thus expresses himself. "*Insectum prorsus singulare* (Stylops melittæ, *Dom. Kirby*), *a Dom. Brebisson accepi. Systemata Entomologica perturbare videtur, cum ex omnibus ordinibus repellatur.* Xenops Vesparum *Rossi animal præcedenti affine et animum pariter excrucians. Tempus ducamus et dies alteri lucem afferent.*" The time he predicted has arrived; and it has been left to the lucid genius of Kirby to substantiate and to characterise this order, which he has done in a paper published in the 11th volume of the *Transactions of the Linnean Society,* from which we shall extract a brief history of the order, genera, and species.

"*Characters of the Order.*

"Body oblong or linear-oblong, somewhat cylindric, covered with a horny integument.

"Head sessile, broader than the trunk, transverse and large. Mouth with no visible labrum, labium, or maxillæ. Mandibles two, corneous, elongate, linear, very narrow; the apex acute, forficate, inserted under the head at the base of the palpi, which are two, biarticulate and very distant. Antennæ inserted in an excavation in the front; base with a two or three-jointed common peduncle, composed of very short joints, terminated by two elongate branches.

"Trunk oblong; wings with nerveures diverging like rays, folding longitudinally, somewhat membranaceous; elytra as if affixed to the base or coxæ of the anterior feet, linear, or somewhat spoon-shaped, at first diverging from the body, and then curving inwards again, lastly again recurving, and not in the slightest degree covering the wings. Legs equal or nearly so in length, compressed; the four anterior ones approximate, the hinder pair remote; all furnished with trochanters, of which the two hinder ones are shortest. Tarsi four-jointed, the first joint largest, the last unarmed."*

341. Stylops. GENUS CCCXLI. STYLOPS. Kirby.

Antennæ bipartite; the branches compressed; the superior branch articulated. Palpi first obconic, large, compressed; second, semi-ovate acute, hollow beneath. Eyes pedunculated, composed of numerous hexagons, the septa but little elevated. Abdomen fleshy, retractile within a process of the trunk. Tarsi with the last joint notched. Mandibles thicker at their extremities.

LARVA unknown; it resides within the bodies of the *Andrenides.*

PUPA with a fleshy body, bearing a corneous exserted head. It is found between the joints of the abdomen of certain *Andrenides.*

Melittæ. *Sp.* 1. *Melittæ.*

342. Xenops. GENUS CCCXLII. XENOPS. Rossi, Kirby.

Antennæ bipartite; the branches not jointed, semirounded. Palpi, first joint compressed, flexuous; second ovate, acute. Eyes pedunculated, composed of fewer hexagons than those of STYLOPS; the septa thicker, and more elevated. Abdomen exserted, horny; anus fleshy. Tarsi with last joint entire. Mandibles thicker towards their middle; apex acute.

LARVA parasitical in the bodies of the *Vespides;* body lancionate, plicate, fleshy; head compressed.

PUPA parasitical under the joints of the abdomen of the *Vespides.* Body linear, fleshy; head horny and exserted; opercula of the eyes fenestrated; the windows hexagonal.

Peckii. *Sp.* 1. *Peckii.* Sooty-black-brown; antennæ with the branches more dilute, dotted with white; anus pale; feet lurid; tarsi brown. Length 1½ line.

Xenos peckii. Kirby, *Lin. Trans.* xi. tab. 8. and 9.

The larva and pupa inhabit the body of *Polistes fuscata* of Fabricius, which is found in America.

Body sooty-black-brown, covered with a velvet-down, which can only be seen by means of a very strong glass. Head between the antennæ longitudinally elevated. Palpi with first joint longest. Antennæ longer than the head; branches pale brown, almost diaphanous, sprinkled with minute dots of white. Thorax behind, in the middle, obtusely angulate. Scutellum longitudinally and broadly grooved or channelled. Postlumbium pale. Wings cinereous-whitish, the margin thicker, the nerves black. Legs cinereous, or rather lurid. Tarsi blackish. Abdomen darker than the rest of the body. Anus pale red.

The branches of the antennæ have their inner surface plain, and are probably, under certain circumstances, applied to each other, so as to form a single columnar branch. The white dots, Mr Kirby suspects, may emit a light (whilst the animal is living); but he gives this idea as a mere conjecture.

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* We have considered it as unnecessary to give the detailed character; we must therefore refer to Mr Kirby's paper, *Linn. Trans.* vol. xi. p. 109—112.

The discovery of this curious insect is due to the assiduous researches of William Dandridge Peck, Esq. professor of natural history in Harward University, Cambridge, New England, who sent specimens, with drawings made from the recent animal, to the celebrated author of the *Monographia Apum Angliæ*, with the following statement, which we have extracted from his letter to Mr Kirby.*

"Your having met with the remains of *Strepsiptera* in foreign *Vespides*, made me determine to look for them in those of this country; and I have the pleasure to find one in a species of *Polistes* that is here very abundant. The abdomen of this *Polistes* is so distorted by them, that I have no difficulty in knowing them when on the wing. Taking them with the gauze forceps, bringing them into a close room, and permitting them to fly to the windows, I caught them again with a wine-glass and a card, fed them with sugar, and thus preserved them till their parasites were disclosed. I had not the pleasure to see them emerge, but I found them soon after. I obtained four in this way, and brought several nests of the *Polistes* into the house, taking them in the night, when all the inhabitants were at home, in the hopes of obtaining more; but I got no living ones.

"All that I know of this animal, was picked up in a few days that I passed at my little place at Newberry. In feeding, the head of the larva is near the base of the abdomen of the wasp, as I found by dissection. When the feeding state is passed, it is easy to conceive that it turns, and with its flattened head separates the membrane which connects the abdominal scuta, and protrudes itself a little way, accurately closing the aperture, which is just large enough to admit it. All this time the wasp is active, and associates with its companions. When just protruded, the head of the larva is of a pale brownish colour; by degrees it assumes a rounder form, and becomes almost black.

"The pupa state ensues; but I suspect that only the part exposed to the air, and that immediately under the pressure of the abdominal ring, becomes hard.

"The four I took were all alike, and I concluded that they were males, from the circumstance of their vibrating their wings, which several lepidopterous insects of that sex do likewise. Be assured, that this indicates eager desire. So my insect, which I confined under a watch-crystal, coursed round its prison, with surprising trepidation, as long as it lived, which was but a few hours."

Rossii. *Sp.* 2. *Rossii.* Deep-black; branches of the antennæ compressed; tarsi brown.

Xenops vesparum. Rossi.

Xenops rossii. Kirby.

Inhabits Polistes Gallica, in Italy.

Body black, smoky. Head small. Palpi with the first joint short, rounded; the second elongate, compressed. Antennæ scarcely longer than the head, though compressed, as if ensiform. Tarsi (four) brown, white beneath.

"Rossi, in his description, which, extraordinary as he deemed his insect, appears to have been drawn up from a very cursory and inaccurate survey of it, mistakes the mandibles for setæ, and seems not to have traced them to their point of insertion under the head, since he merely says, '*Labium breve, medio setigerum.*' He takes no notice of the eyes being placed in a footstalk or pillar. The elytra he regards as an appendage of the thorax, something similar to the haltares or poisers of the *Diptera*."

Mr Kirby has never seen *Xenops Rossi*, but has merely copied Rossi's account. Upon comparing the descriptions of the two species, we find that they not only differ in colour, but also in the length of the first joint of the palpi compared with the second, and in the form of the branches of the antennæ. Rossi makes no mention of the minute white dots which render those of *Xenops Peckii* so very remarkable; we therefore think, that Mr Kirby is fully justified in considering them as distinct. Should the proportion of the joints of the palpi be found in nature to be the same as expressed in Rossi's figure, these animals cannot be referred even to the same genus, but must constitute a new one.

ORDER V. DERMAPTERA.

ORDER DERMAPTERA. Kirby.
ORDER COLEOPTERA. Linn. Marsh.
ORDER ORTHOPTERA. Latr. Lam.

Characters of the Order.

Elytra somewhat crustaceous and abbreviated, of a square form; the suture straight. Wings membranaceous, externally coriaceous, large, folded transversely and longitudinally. Anus armed with a forceps, which is horny and moveable. Body linear depressed. Antennæ inserted before the eyes, composed of from twelve to thirty joints; the first articulation largest, the second very small, the others short, obconic, or nearly globose. Mandibles with their points bidentate. Palpi filiform, terminated with a very obscure tuberculiform little body or spine. Tarsi three-jointed, villose beneath. Eyes triangular-orbicular, and but little prominent.

Observation. The genera are founded on the number of joints in the antennæ.

GENUS CCCXLIII. FORFICULA. Linn. Fabr. Latr. Lam. Cuv. 343. For cula.

Antennæ composed of fourteen joints.

Sp. 1. *Auricularia.* Forceps at the base internally denticulated, and a little beneath with a tooth on each side. Elytra yellowish-brown, with the disc darker. Auricularia.

Forficula auricularia of authors.

Inhabits Europe. Mr Marsham has considered the sexes of this insect as two species, under the names *auricularia* and *neglecta*.

GENUS CCCXLIV. LABIA. Leach. 344. La

FORFICULA. Fabr. Latr.

Antennæ twelve-jointed.

Sp. 1. *Minor.* Forceps denticulated within. Minor.

Forficula minor. Fabr. Panz.

Inhabits Europe. The forceps of the male are somewhat larger than that of the female, which character Mr Marsham has considered as specific.

GENUS CCCXLV. LABIDURA. Leach. 345. La dura.

FORFICULA. Fabr.

Antennæ with about 30 joints.

Sp. 1. *Gigantea.* Entirely testaceous-yellow. Gigant

Forficula gigantea. Fabr.

Inhabits Europe. It was discovered to inhabit Britain, by the Rev. William Bingley, who observed them on the sea-coast, near Christchurch, Hampshire, where they occurred in great abundance.

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* We shall transcribe this part of Mr Kirby's paper, with the exception of the terms; which we shall change for those adopted in this article.

ORDER VI. ORTHOPTERA.

Order ORTHOPTERA. Oliv. Lam. Latr.
Class ULONATA. Fabr.
Order HEMIPTERA. Linn.

Characters of the Order.

Elytra coriaceous, the internal margin of one overlapping the same margin of the other. Wings membranaceous, the anterior margin coriaceous, longitudinally folded. Palpi short. Body elongate, narrow. Tarsi with four or three, very rarely with five joints.

TRIBE I. MANTIDES.

Elytra and wings horizontal; the latter simply longitudinally folded. Tarsi five-jointed. Body somewhat cylindric or linear. Feet not formed for leaping.

FAMILY I. *Phasmida.*

Anterior feet not raptorious. Thorax composed of two segments.

46. Phasma. GENUS CCCXLVI. PHASMA. Licht. Fabr. Latr. Leach.

MANTIS. Linn. De Geer, Oliv.

SPECTRUM. Stoll. Lam.

Body cylindric, filiform, winged. Thorax cylindric, second segment much longer than the first. Feet simple.

Violascens. *Sp.* 1. *Violascens.* Green, with the external edge of the elytra yellowish; the wings, with the exception of the coriaceous margin, violet; the four hinder thighs spiny beneath.

Phasma violascens. Leach, *Zoolog. Miscel.* vol. i. p. 26. tab. 9.

Inhabits New Holland.

47. Spectrum. GENUS CCCXLVII. SPECTRUM. Stoll. Lamarck, Leach.

PHASMA. Fabricius, Latreille.

Body cylindric, filiform, without wings. Feet simple.

ossium. *Sp.* 1. *Rossium!* Body green, or ash-coloured brown, somewhat obsoletely granulated, with a dorsal carinula; feet filiform, angulate-striate; thighs towards their joints beneath with one tooth.

Phasma rossia. Fabricius, Latreille.

Inhabits Italy and the southern parts of France.

48. Phyllium. GENUS CCCXLVIII. PHYLLIUM. Illiger, Latreille.

MANTIS. Linn. Fabr. Oliv.

PHASMA. Lich. Lam.

SPECTRUM. Stoll.

Body oblong, very much depressed, with elytra and wings. Abdomen oval or elliptic membranaceous.

icifolium. *Sp.* 1. *Siccifoluim.* Bright green.

Mantis siccifolia. Lin. Fabr. Donovan, *Nat. Hist. of the Insects of India*, No. 8. fig. 8.

Inhabits the Molucca Isles.

FAMILY II. *Mantida.*

Anterior feet raptorious. Thorax composed of one segment.

9. Empusa. GENUS CCCXLIX. EMPUSA. Illig. Latr.

MANTIS. Linn. Fabr. Oliv. Stoll. Lam. Lich.

Antennæ of the male pectinated. Head produced into a horn. Four hinder feet having their knees adorned with leaf-processes.

ndica. *Sp.* 1. *Mendica.*

Mantis mendica. Fabr. Latr. Stoll. *Mant.* tab. 12. fig. 47.

Mantis. GENUS CCCL. MANTIS. Linn. Latr. Fabr. Oliv. Lam. Lich. Latr. Stoll.

Antennæ in both sexes simple. Head without an horn. Legs all simple.

Religiosa. *Sp.* 1. *Religiosa.* Pale green, somewhat linear; thorax half the length of the elytra, three times longer than broad. Back, with the exception of the anterior part, longitudinally carinated. Lateral margins yellowish, denticulated. Elytra linear, glaucous transparent green, the exterior margin yellowish. Wings of the same colour with the elytra, but paler and more transparent, the tips brownish. Anterior legs with denticulated coxæ. Anterior thighs yellowish within, denticulated at the base beneath; the spines with black tips.

Mantis religiosa. Linn. Latr.

Le Mante. Geoffroy.

Mantis oratoria var β. Fabricius.

Gryllus religiosus. Scopoli.

Inhabits the commons and wastes of southern Europe.

TRIBE II. ACHETIDES.

Elytra horizontal. Wings longitudinally folded, often produced beyond the elytra. Tarsi three-jointed. Hinder feet formed for jumping.

FAMILY I. *Gryllotalpida.*

Antennæ not longer than the thorax. Anterior feet compressed, formed for digging. Oviduct not exserted.

351. Gryllotalpa. GENUS CCCLI. GRYLLOTALPA. Ray, Latreille.

GRYLLUS (*Acheta.*) Linn.

ACHETA. Fabr.

Antennæ setaceous, composed of a vast number of joints, (beyond sixty.) Anterior tibiæ and tarsi formed for digging; two first joints of the tarsi very large, dentiform. Hinder feet little formed for jumping.

Vulgaris. *Sp.* 1. *Vulgaris.* Above fuscous, ferruginous-yellowish beneath; anterior tibiæ quadridentate; wings twice the length of the elytra.

Gryllus gryllotalpa. Linn.

Acheta gryllotalpa. Fabricius.

Gryllotalpa vulgaris. Latreille.

Inhabits Europe. The male sings in the evening by rubbing the elytra together.

Didactyla. *Sp.* 2. *Didactyla.* Anterior tibiæ bidentate.

Inhabits Cayenne.

This species has been confounded with *G. vulgaris* in several cabinets.

352. Tridactylus. GENUS CCCLII. TRIDACTYLUS. Olivier, Latr.

ACHETA. Coquebert.

Antennæ moniliform, (very short), ten-jointed. Anterior tibiæ with their joints only spinous. Hinder feet well calculated for leaping.

Paradoxus. *Sp.* 1. *Paradoxus.* Pale luteous; thorax pale fuscous, the sides pale luteous; elytra half the length of the abdomen, brown, hyaline externally with white tips; wings a little longer than the abdomen, with their base white, then pale brown, transversely striated.

Inhabits Guinea. It is the *Acheta digitata* of Coquebert, tab. 21. fig. 8.

FAMILY II. *Achetida.*

Feet not formed for digging. Oviduct exserted, Antennæ longer than the thorax.

353. Acheta. GENUS CCCLIII. ACHETA. Fabr.

GRYLLUS. Linn. Geoff. Latr. Oliv. Lam.

Campestris. *Sp.* 1. *Campestris.* Body three times longer than broad, black, shining.

Gryllus campestris. Linn. Latr.

Acheta campestris. Fabricius.

Inhabits the temperate parts of Europe. Is not very common in Britain.

TRIBE III. LOCUSTIDES.

Elytra and wings oblique. Hinder feet formed for jumping. Tarsi four-jointed. Antennæ setaceous.

354. LOCUSTA. GENUS CCCLIV. LOCUSTA.* Geoff. De Geer, Fabr. Oliv. Lam. Latr.

GRYLLUS (*tettigonia*). Linn.

Hinder feet twice the length of the body. Oviduct exserted.

Viridissima. *Sp.* 1. *Viridissima.* Green; antennæ, vertex, dorsum of the thorax, and suture of the elytra, fuscous-ferrugineous.

Locusta viridissima. Fabricius, Latreille.

Gryllus viridissimus. Linn.

Inhabits Europe. In the autumn, the perfect insect may be found in great plenty near London.

TRIBE IV. GRYLLIDES.

Elytra and wings oblique. Hinder feet formed for jumping. Tarsi with three joints. Antennæ filiform or ensiform. Oviduct not exserted.

FAMILY I. *Gryllida.*

Wings not covered by the scutellum.

355. PNEUMORA. GENUS CCCLV. PNEUMORA. Thumb. Latr.

GRYLLUS (*Locusta*). Linn.

ACRYDIUM. De Geer, Olivier.

Antennæ filiform, composed of from 16 to 20 joints. Abdomen bladder like, as if inflated. Feet all shorter than the body.

The species of this curious genus are not well defined; we shall therefore be silent respecting them, lest we add to their confusion.

356. TRUXALIS. GENUS CCCLVI. TRUXALIS. Fabricius, Olivier, Lambert, Latreille.

GRYLLUS, (*Acrida.*) Linn.

ACRYDIUM. De Geer.

Antennæ ensiform. Body narrow-elongate. Thorax behind dilated into an angle. Hinder legs longer than the body.

The species are numerous, but are little known, one species having been confounded with another.

Nasatus. *Sp.* 1. *Nasutus.* Fabricius.

357. GRYLLUS. GENUS CCCLVII. GRYLLUS. Fabricius, Panzer.

GRYLLUS, (*Locusta.*) Linn.

Antennæ filiform, or terminated in a club. Hinder legs not, or scarcely, longer than the body.

This genus comprehends a vast number of species.

Migratorius. *Sp.* 1. *Migratorius.* Thorax somewhat carinated; mandibles blue.

This species has been taken in Britain occasionally; but in the year 1748 it appeared in several irregular flights, in several parts of Europe, (as we have mentioned in our list of entomological writers,) and visited England, but they perished in a very short time, before they did much harm.

Of all the insects which are capable of adding to the calamities of the human race, locusts seem to possess the most formidable powers of destruction. Legions of these voracious animals, of various species, are produced in Africa, where the devastations they commit is almost incredible. The air is darkened by their numbers; they carry desolation with them wherever they pass; and, in the short space of a few hours, are said to change the most fertile provinces into a barren desert.

Some of the species serve as food, and are eaten fresh as well as salted. In the latter state they are constantly exposed to sale in the Levant; but the quantity of nutritious matter is said to be very small.

FAMILY II. *Acrydida.*

Wings covered by the scutellum.

358. ACRYDRIUM. GENUS CCCLVIII. ACRYDRIUM. Fabricius, Geoffroy, De Geer, Olivier.

ACHETA. Lamarck.

GRYLLUS, (*Bulla.*) Linn.

TETRIX. Latreille.

Subulata. *Sp.* 1. *Subulata.* Obscure testaceous brown, granulose; thorax carinated, marginated.

Gryllus subulatus. Linn.

Acrydrium subulatum. Fabricius, Olivier.

Tetrix subulata. Latreille.

Inhabits Europe. It is found in hot banks, and is subject to some variation in colour.

The species of *Acrydrium* are but little understood. We seem to possess three very distinct indigenous species, all varying in size, sculpture, and colour.

ORDER VII. DICTUOPTERA.

Order HEMIPTERA. Linn.
Class ULONATA. Fabricius.
Order ORTHOPTERA. Latreille.
Order DICTUOPTERA. Leach.

Characters of the Order.

Elytra coriaceous, nervosæ, decussating each other. Wings membranaceous, with a few longitudinal folds. Maxillary palpi elongate. Body depressed, oval, or somewhat orbicular. Tarsi with five joints.

359. BLATTA. GENUS CCCLIX. BLATTA. Linn. Fabricius, &c.

Orientalis. *Sp.* 1. *Orientalis.* Elongate-ovate, ferruginous brown. Thorax semicircular, truncate before.

Inhabits North America. Is common in Europe in houses, but is not indigenous to that quarter of the globe.

The genus *Blatta* may be defined, (as it now stands,) to be a general reservoir for all insects, agreeing with the character of the order. Much might be done towards elucidating this hitherto neglected part of entomology; and we trust that some entomographer, who has time, will devote some share of his attention to the examination of the genera and species.

ORDER VIII. HEMIPTERA.

Order HEMIPTERA. Linn. Lamarck, Cuvier, Leach.
Class RHYNGOTA. Fabricius.
Order HEMIPTERA, Section 1. HETEROPTERA. Latr.

Characters of the Order.

Rostrum attached to the anterior extremity of the head. Elytra somewhat crustaceous, or coriaceous with the apex membranaceous, placed in an horizontal direction, one decussating the other. Thorax with the first segment, (which bears the feet,) larger than the following one. Haustellum with three setæ. Ocelli or little eyes, two, one obsolete.

Obs. The metamorphosis of all the order is semi-complete.

SECTION I. TERRESTRIA.

Obs. The insects which compose this section are not only distinguished from the second section by their economy, but likewise by the structure of some essential organs. The antennæ of this division are exserted, and are very distinct.

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* *Locusta verrucivora* of Fabricius, *Gryllus verrucivorus* of Linnæus, has lately been taken in plenty near Rochester, by J. Henslow, Esq. of St John's College, Cambridge.

TRIBE I. PENTATOMIDES.

Antennæ composed of five joints. Rostrum with four distinct joints, the three first of nearly an equal length. Labrum very long, striated. Tarsi with three distinct joints, the first elongate. Head trigonate, immersed even to the eyes in the thorax.

FAMILY I. *Scutellerida.*

Scutellum elongate, covering the elytra and the wings.

360. SCUTELLERA. GENUS CCCLX. SCUTELLERA. Lam. Latr. Leach.
TETYRA. Fabricius.
CIMEX. Linn. Gmelin, Wolff.

Scutellum covering the whole of the abdomen, longer than broad. Thorax very narrow in front. Antennæ with the second joint shorter than the third.

Sexmaculata. *Sp.* 1. *Sexmaculata.* Red shining with silver; feet, antennæ, middle of the thorax, six spots on the scutellum, breast, epigastrium, and margin of the abdomen, black.
Scutellera sexmaculata. Leach's *Zoological Miscellany,* vol. i. p. 36. tab. 14.
Inhabits new Caledonia.

361. TETYRA. GENUS CCCLXI. TETYRA. Fabricius, Leach.
SCUTELLERA. Latreille.
CIMEX. Linn.

Scutellum longer than broad, not covering the sides of the abdomen. Thorax very narrow in front. Antennæ with the second joint longer than the third.

Lineata. *Sp.* 1. *Lineata.* Red, thorax with six black lines; scutellum with four black spots; marginal spots of the abdomen, and six lines of black punctures.
Cimex lineatus. Linn.
Tetyra nigro-lineata. Fabricius.
Scutellera nigro-lineata. Latreille.
Inhabits the southern parts of Europe.

362. THYREOCORIS. GENUS CCCLXII. THYREOCORIS. Schrank, Leach.
SCUTELLERA. Latreille.
TETYRA. Fabricius.
CIMEX. Wolff.

Scutellum broader than long. Antennæ with the second joint very short. Thorax with the anterior margin not much narrower than the hinder margin.

Globus. *Sp.* 1. *Globus.* Orbiculate, somewhat triangular, broader behind, shining brassy-black, punctate; base of antennæ, row of punctures on each side of the abdomen, and knees, red-yellowish; scutellum with an impressed arcuate line on each side of the base.
Tetyra globus. Fabricius.
Cimex globus. Wolff. *Icon. Cim.* fas. 1. p. 3. tab. 1. fig. 3.
Inhabits southern Europe.

FAMILY II. *Pentatomida.*

Scutellum not covering the wings or elytra.

363. ÆLIA. GENUS CCCLXIII. ÆLIA. Fabricius.
CIMEX. Linn. Wolff.
PENTATOMA. Latreille.

Body ovate. Thorax with the anterior margin much narrower than the hinder. Head longer than broad. Antennæ with the second joint not longer than the third; their base covered by the lateral margins of the head.

Acuminata. *Sp.* 1. *Acuminata.* Pale-yellowish, longitudinally lineated with fuscous, impressed-punctate; a fuscous band running down the middle of the back, divided by a whitish line; last joint of the antennæ red.
Cimex acuminatus. Linn.
Ælia acuminata. Fabricius.
Pentatoma acuminatum. Latreille.
Inhabits grassy places. It is rare in Britain.

364. PENTATOMA. GENUS CCCLXIV. PENTATOMA. Olivier, Latreille.
CIMEX. Fabricius, Wolff.

Body ovate. Thorax with the anterior margin much narrower than the hinder. Head with nearly equal diameters.

Bidens. *Sp.* 1. *Bidens.* Body griseous above; thorax with a lengthened spine on each side behind.
Cimex bidens. Fabricius.
Pentatoma bidens. Latreille.
Inhabits Europe.

Prasinus. *Sp.* 2. *Prasinus.* Green above; hinder angles of the thorax without spines.
Cimex prasinus. Fabricius.
Inhabits Europe.

365. CYDNUS. GENUS CCCLXV. CYDNUS. Fabricius.
PENTATOMA. Latreille.

Body ovate, somewhat orbicular; anterior margin of the thorax narrower than the hinder. Head nearly semicircular. Antennæ with the second joint longer than the third. Tibiæ spinulose.

Oleraceus. *Sp.* 1. *Oleraceus.* Brassy dark green; sides of the head and thorax with a longitudinal line, on the latter red; outer margin of the elytra, a spot on each, with two spots and the apex of the scutellum red; thighs, (apex excepted,) and middle of the tibiæ yellowish.
Inhabits Europe.

TRIBE II. COREIDES.

Antennæ composed of four joints. Rostrum with four distinct joints, the first three of nearly an equal length. Labrum very long, striated. Tarsi with three distinct joints, the first elongate. Head trigonate, immersed even to the eyes within the thorax.

366. COREUS. GENUS CCCLXVI. COREUS.[*] Fabricius, Lamarck, Wolff. Latreille.
CIMEX. Linn. Geoffroy, &c.

Antennæ inserted above a line drawn from the eyes to the base of the labrum; the last joint thick. Thorax with the anterior narrower than the posterior margin. Body ovate, the sides of the abdomen dilated. Head trigonate; neck not apparent.

Marginatus. *Sp.* 1. *Marginatus.* Red-fuscous, obscure; sides of the abdomen elevated, acute; antennæ with their internal base unidentate, the first and last joints blackish, the middle ones red; thighs beneath with a canal, and a few little teeth.
Coreus marginatus. Fabricius, Latreille.
Cimex marginatus. Linn.
Inhabits Europe. Is common on the dock.

367. BERYTUS. GENUS CCCLXVII. BERYTUS. Fabricius.
NEIDES. Latreille.

Antennæ inserted above a line drawn from the eyes to the base of the labrum; geniculated about their middle; the first joint very long, the last thick. Body filiform. Head somewhat conic; neck not apparent. Scutellum minute, linear-conic. Feet elongate. Thighs clavate.

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[*] From the COREUS, Dr Leach has formed a genus which he has named MYCTIS, the characters of which are vertex with two ocelli placed transversely; antennæ filiform, four-jointed, joints cylindric, equal, or with the first joint rather longest. Anterior four feet alike in size and form; hinder ones with thick thighs, and with the internal side of the tibiæ dilated; tarsi with the first joint longer than the other two conjoined. Body elongate, flat above; thorax triangular, very narrow in front; abdomen with dilated sides. This genus contains several species, one of which is figured in the first vol. of *Zoological Miscellany*, p. 92. tab. 40. under the title of *Myctis Crucifera*.

Tipularius. *Sp.* 1. *Tipularius.* Reddish-gray; antennæ as long as the body, with the last joint fuscous; clypeus acuminate, and produced; thorax with three elevated lines, which are parallel and longitudinal, two of these are marginal, the other dorsal; elytra striate nervous, impressed-punctate, spotted with fuscous.

Cimex tipularius. Linn.
Berytus tipularius. Fabricius.
Neides tipularius. Latreille.
Inhabits grassy places.

368. Lygæus. Genus CCCLXVIII. Lygæus. Fabr. Wolff, Latr.
Cimex. Linn. De Geer, &c.

Antennæ filiform, inserted beneath a line drawn from the eyes to the base of the labrum. Body elongate-ovate. Head trigonate, neck not apparent.

Apterus. *Sp.* 1. *Apterus.* Red, with black spots. Elytra abbreviated.

Cimex apterus. Stewart.
Lygæus apterus. Fabricius.
Inhabits Europe.

369. Capsus. Genus CCCLXIX. Capsus. Fabricius, Latreille.
Cimex. Linn.
Lygæus. Wolff.

Head trigonate, neck not apparent. Antennæ setaceous; the second joint at the apex thick, the two last when combined, much shorter than the one before it.

Ater. *Sp.* 1. *Ater.* Body black.
Inhabits Europe in grassy places every where.

370. Miris. Genus CCCLXX. Miris. Fabr. Latr.
Cimex. Linn. Geoff. &c.
Lygæus. Wolff.

Antennæ setaceous, the second and following joints alike. Head trigonate. Neck not apparent.

Vagans. *Sp.* 1. *Vagans.*
Lygæus Vagans. Wolff, &c. *Cim.* fas. 4. p. 159. tab. 16. fig. 158.

371. Myodocha. Genus CCCLXXI. Myodocha. Latreille.
Cimex. De Geer.

Head ovoid, with a distinct neck. Antennæ slightly thicker towards their extremities.

Tipuloides. *Sp.* 1. *Tipuloides.*
Cimex tipuloides. De Geer, *Mem. sur les Insectes,* 5. 354. tab. 35. fig. 18.
Myodocha tipuloides. Latreille.

Tribe III. Cimicides.

Rostrum with two or three distinct joints. Labrum very short, not projecting. Feet simple. Eyes not very large.

Family I. *Cimicida.*

Feet formed for walking on the earth, with distinct nails.

372. Nabis. Genus CCCLXXII. Nabis. Latreille.
Cimex. De Geer.
Reduvius. Wolff.

Body not linear. Antennæ inserted below the middle of the head. Rostrum, with the second joint almost as long as the third. Thorax not bilobed.

Gigas. *Sp.* 1. *Gigas.* Brown, obscurely rayed with red.
Reduvius gigas. Wolff. *Cim.* 12. fig. 113.

373. Reduvius. Genus CCCLXXIII. Reduvius. Fabr. Oliv. Lam. Latr.
Cimex. Linn. Geoff. De Geer.

Body not linear. Antennæ inserted above a line drawn from the eyes to the base of the rostrum. Rostrum, with the middle joint evidently longer than the others. Thorax bilobate, abruptly elevated behind. Tibiæ alike, elongate, somewhat cylindric.

Sp. 1. *Personatus.* Black. Personatu
Reduvius personatus. Fabr. Latr.
Inhabits Europe, is often found in houses, and is said to destroy the common house bug *Cimex lectularius.*

Genus CCCLXXIV. Petalochirus. Leach. 374. Petalochirus.
Petalocheirus. Palissot de Beauvois.
Reduvius. Latreille.

Body not linear. Rostrum, with the middle joint evidently longer than the others. Thorax abruptly elevated behind, bilobate. Anterior tibiæ dilated into an oval plate.

Sp. 1. *Variegatus.* Body variegated. Variegatu
Petalocheirus variegatus. Palissot de Beauvois.
Inhabits Africa.

Genus CCCLXXV. Zelus. Fabricius, Latreille. 375. Zelus.
Cimex. Linnæus, De Geer.

Body linear. Anterior pair of feet like the others in form; four hinder ones very long, and filiform.

Sp. 1. *Longipes.* Longipes
Zelus longipes. Fabr. Latr.

Genus CCCLXXVI. Ploiaria. Scopoli, Latreille. 376. Pl… aria.
Gerris. Fabricius, Schellenberg.
Cimex. Geoffroy.

Body filiform. Four posterior feet very long, filiform; anterior feet raptorious, with very long coxæ.

Sp. 1. *Vagebunda.* Vagebunda.
Gerris vagebundus. Fabricius.

Genus CCCLXXVII. Cimex. Linn. Latr. 377. Cimex.
Acanthia. Fabricius.

Body depressed. Rostrum short, setaceous. Wings none.

Sp. 1. *Lectularius.* Reddish brown, with short hair. Lectula
Cimex lectularius. Linn. Fabr. Latr. &c.
Acanthia lectularia. Fabricius.
Inhabits European houses, sucking the blood of man. The common bug.

Genus CCCLXXVIII. Macrocephalus. Swederus. 378. M… croce… phalu
Syrtis. Fabricius.
Acanthia. Schellenberg, Wolff.

Abdomen with the sides dilated into an angle. Anterior feet raptorious. Antennæ capitate, the last joint very large, elongate-ovate. Scutellum very large, unconnected with the thorax, covering nearly the whole of the abdomen.

Sp. 1. *Cimicoides.* Cimico
Macrocephalus cimicoides. Swederus, *Nov. Act. Stockh.* 8. 1787. 3. tab. 8. Fig. 1.
Syrtis manicata. Fabricius.
Inhabits Georgia and Carolina.

Genus CCCLXXIX. Phymata. Latreille, Leach. 379. … mata
Syrtis. Fabricius.
Acanthia. Schellenberg, Wolff.

Body membranaceous, lateral margins elevated. Thorax prolonged into a scutellum behind. Antennæ contiguous at their base, with the last joint thicker and larger, received into a cavity under the sides of the thorax. Anterior feet raptorious.

Sp. 1. *Crassipes.* Crass
Syrtis crassipes. Fabricius.
Phymata crassipes. Latreille.
Inhabits France and Germany.

Genus CCCLXXX.[1] Tingis. Fabricius, Latr. 380. … gis.
Cimex. Linn. Geoff. De Geer.
Acanthia. Schrank, Schellenberg, Wolff.

Body entirely depressed, reticulated. Feet all simple. Antennæ terminated by an oval joint, the third joint very long.

Metabolia. *Sp.* 1. *Cardui.* Body greyish.
Tingis cardui. Fabricius, Panzer, Latreille.
Inhabits thistles.

80. Ara-dus. Genus CCCLXXX. Aradus. Fabricius, Panzer.
Cimex. Linn. Geof. De Geer.
Acanthia. Schrank, Wolff.
Coreus. Schellenberg.
Body depressed. Feet all simple. Antennæ with cylindric joints, the second articulation longest.

Lunatus. *Sp.* 1. *Lunatus.*
Aradus lunatus. Fabricius, Latreille.
Inhabits Europe.

Family II. *Gerrida.*

Feet very long, formed for walking on the water, with the nails very minute, inserted laterally into a fissure at the extremity of the last joint of the tarsi.

381. Hydrometra. Genus CCCLXXXI. Hydrometra. Latreille, Lamarck, Fabricius.
Cimex. Linnæus, Geoffroy.
Aquarius. Schellenberg.
Antennæ setaceous, the third joint much longer than the rest. Anterior feet simple. Head elongate-cylindric, apex thickened.

tagnorum. *Sp.* 1. *Stagnorum.* Black above; feet brown-reddish.
Hydrometra stagnorum. Fabricius.
Cimex stagnorum. Linnæus.
Aquarius paludum. Schellenberg.
Inhabits Europe in moist places.

82. Velia. Genus CCCLXXXII. Velia. Latreille.
Cimex. Rossi.
Hydrometra. Fabricius.
Antennæ filiform, the first joint longest. Anterior feet raptorious. Rostrum two-jointed. Head somewhat vertical.

Rivulorum. *Sp.* 1. *Rivulorum.* Black; sides of the thorax and margins of the abdomen red. Thorax with two anterior punctures; each elytra with three, and a spot of white; inferior sides of the abdomen punctured with black.
Hydrometra rivulorum. Fabricius.
Velia rivulorum. Latreille.
Inhabits running water and springs.

rens. *Sp.* 2. *Currens.* Apterous, black. Thorax anteriorly, with two silky white spots. Middle of the under part of the abdomen, and its elevated margin, with red punctures.
Velia currens. Latreille.
Hydrometra currens. Fabricius.
Inhabits Europe.
Dr Leach is of opinion, that this is merely the young state of the preceding species.

Ger-. Genus CCCLXXXIII. Gerris. Latreille.
Cimex. Linnæus, De Geer, Schrank, Geoffroy.
Aquarius. Schellenberg.
Hydrometra. Fabricius.
Antennæ filiform, the first joint longest, the last cylindric. Anterior feet raptorious. Rostrum three-jointed. Head porrected.

dum. *Sp.* 1. *Paludum.* Brown-olive, black above, cinereous, silky beneath. Abdomen nearly equally broad. Trunk as long as the head, carinated beneath, a series of impressed lines on each side. Antennæ and feet black. Thorax with an elevated line, extending to the middle of the back. Lateral margins of the thorax and abdomen with the anus reddish.
Hydrometra paludum. Fabricius.
Gerris paludum. Latreille.
Inhabits France, England, and Sweden.

The species of this genus are certainly but little known; they are either subject to great variation, or are very numerous. Metabolia.

Tribe IV. Acanthides.

Labrum prominent. Eyes very large. Feet formed for walking and jumping.

Genus CCCLXXXIV. Acanthia. Schrank, Latr. 384. Acanthia.
Cimex. Linnæus, De Geer, Geoffroy.
Salda. Fabricius.
Lygæus. Wolff.
Antennæ filiform. Rostrum straight, long.

Sp. 1. *Maculata.* Black spotted, with pale colour. Maculata.
Acanthia maculata. Latreille.
Inhabits Europe in moist places.

Genus CCCLXXXV. Leptopus. Dufour, Latr. 385. Leptopus.
Antennæ setaceous. Rostrum arcuate, short.
Obs. Of the species we know nothing; the genus was first observed by Dufour in southern France.

Section II. Aquatica.

Antennæ very minute, not exserted, inserted beneath the eyes.

Obs. All the insects of this Section live in the water.

Tribe V. Belostomides.

Tarsi alike, all cylindric, biarticulated, and furnished with nails. Body depressed.

Family I. *Pelogonida.*

Anterior feet not raptorious.

Genus CCCLXXXVI. Pelogonus. Latreille. 386. Pelogonus.
Feet all formed for walking. Tarsi of the anterior pair of feet, with the first joint very short. Body orbiculate-ovate. Antennæ four-jointed.

Sp. 1. *Marginatus.* Marginatus.
Pelogonus marginatus. Latreille, *Gen. Crust. et Ins.* 3. 143.
Acanthie bordée. Latreille, *Hist. Nat. des Crust. et des Insect.* 12. p. 142.
Inhabits the south of France.

Family II. *Belostomida.*

Anterior feet raptorious.

Genus CCCLXXXVII. Galgulus. Latreille. 387. Galgulus.
Naucoris. Fabricius.
Tarsi of all the feet biarticulate, cylindric, with two strong equal nails. Antennæ simple, inserted beneath the internal angle of the eyes, three-jointed.

Sp. 1. *Oculatus.* Oculatus.
Galgulus oculatus. Latreille.
Naucoris oculatus. Fabricius.
Inhabits Carolina.

Genus CCCLXXXVIII. Belostoma. Latreille. 388. Belostoma.
Tarsi of the anterior feet with a simple nail. Antennæ semi-pectinate, inserted under the eyes, four-jointed.

Sp. 1. *Testaceo-pallidum.* Pale, testaceous, eyes cinereous. Testaceo-pallidum.
Belostoma testaceo pallidum. Latreille.
Inhabits South America.

Tribe VI. Nepides.

Anterior tarsi united with the tibiæ. Body depressed or linear.

Family I. *Naucorida.*

Anus without setæ. Tarsi of the four posterior feet distinctly biarticulate. Antennæ four-jointed.

389. NAUCORIS. GENUS CCCLXXXIX. NAUCORIS. Geoffroy, Fabricius, Olivier, Latreille.

NEPA. Linnæus, De Geer.

Four posterior feet ciliated, formed for swimming. Antennæ inserted beneath the eyes. Body ovate, much depressed.

Obs. This genus, in habit, make a near approach to the family *Belostomida*, and should perhaps be placed in that division.

FAMILY II. *Nepida.*

Anus furnished with two setæ. Tarsi of the four posterior feet one jointed. Antennæ three jointed.

390. NEPA. GENUS CCCXC. NEPA. Linn. De Geer, Fabr. Oliv. Lam. Latr.

HEPA. Geoffroy.

Rostrum perpendicularly inflected. Body oval. Anterior thighs thick. Four hinder feet not elongate-filiform.

Cinerea. *Sp.* 1. *Cinerea.* Dark-greyish-black.

Nepa cinerea. Linn. Fabr. Latr.

Punaise d'eau scorpion aquatique. De Geer.

Le Scorpion aquatique a corps ovale. Geoffroy.

Inhabits the ditches of Europe.

391. RANATRA. GENUS CCCXCI. RANATRA. Fabr. Schellenberg, Latr.

NEPA. Linn. De Geer, Oliv. Lam.

HEPA. Geoffroy.

Rostrum porrected. Body linear. Four hinder feet very long, filiform. Thighs of anterior feet elongate.

Linearis. *Sp.* 1. *Linearis.* Greyish-brown.

Ranatra linearis. Fabr. Latr. Schell.

Nepa linearis. Linn.

Punaise d'eau scorpion allongé. De Geer.

Le Scorpion aquatique à corps allongé. Geoff.

Inhabits the ditches and ponds of Europe. It is very local in this country. It may occasionally be found near London in Copenhagen Fields, and in ponds near Hammersmith. It has likewise been taken near Halesworth in Suffolk.

TRIBE VI. NOTONECTIDES.

Tarsi of anterior feet not united with the tibiæ. Body depressed cylindric, or cylindric-oval.

FAMILY I. *Notonectida.*

Tarsi all with two joints.

392. NOTONECTA. GENUS CCCXCII. NOTONECTA. Linn. Geoff. Fabr. Oliv. Latr.

NEPA De Geer.

Scutellum triangular, large. Four anterior feet with strong nails; the hinder pair elongate, ciliated, with very minute nails.

Glauca. *Sp.* 1. *Glauca.*

Notonecta glauca. Linn. Fabr. Latr.

Inhabits fresh waters of Europe.

FAMILY II. *Corixida.*

Tarsi of the four anterior feet one jointed, of the hinder pair two-jointed.

393. CORIXA. GENUS CCCXCIII. CORIXA. Geoff. Oliv. Lam. Latr.

NOTONECTA. Linn.

NEPA. De Geer.

SIGARA. Fabr. Schrank, Schellenberg.

Anterior pair of feet without nails; the other feet long, furnished with nails. Scutellum none.

Striata. *Sp.* 1. *Striata.*

Notonecta striata. Linn.

Sigara striata. Fabr.

Corixa striata. Latr.

This species seems to be subject to very great variety in colour and size. It occurs in almost every pond and rivulet, especially where the bottom is slimy.

ORDER IX. OMOPTERA.

Order HEMIPTERA. Linn. Cuvier, Lamarck.

Class RYNGOTA. Fabricius.

Order HEMIPTERA, Section 2, *Homoptera.* Latr.

Order OMOPTERA. Leach.

Characters of the Order.

Rostrum attached to the inferior part of the head. Elytra coriaceous or membranaceous throughout, suture straight. Thorax composed of two segments, the second as long or longer than the first. Ocelli three.

Observe. Metamorphosis semicomplete, or incomplete.

TRIBE I. TETTIGONIDES.

Antennæ composed of six distinct joints. Ocelli or little eyes three. Tarsi with three joints.

394. TETTIGONIA. GENUS CCCXCIV. TETTIGONIA. Fabr.

CICADA. Lamarck, Geoff. Linn. De Geer, Latr.

Thighs of the anterior feet thick, dentate.

Hæmatodes. *Sp.* 1. *Hæmatodes.* Body slightly silky tomentose, black; anterior segment and margins of the thorax, sides of the abdomen and nerveurs of the elytra, ferruginous-red.

Cicada hæmatodes. Linn. Latr.

Tettigonia sanguinea. Fabr.

Inhabits southern Europe.

TRIBE II. CICADIDES.

Antennæ three-jointed. Ocelli two. Tarsi with three joints.

FAMILY I. *Fulgerida.*

Antennæ not inserted in the internal sinus of the eyes; the two first joints conjoined shorter than the head.

GENUS CCCXCV. FULGORA. Linn. Fabr. Latr. Oliv. Cuv. 395. FULGORA.

Front produced into a rostrum. Eyes globular.

Sp. 1. *Lanternaria.* Rostrum very large oval. Elytra and wings variegated, with true wings ocellated. Lanternaria.

Fulgora lanternaria. Linn. Fabr. Latr.

Inhabits Surinam. The rostrum of this, (as of all other species of the Genus) emits a phosphorescent light in the dark. The light of this species is so very vivid, as to enable one to read a newspaper.

Sp. 2. *Candelaria.* Front with a subulate, ascending rostrum. Elytra green, variegated with yellowish. Wings yellow with black tips. Candela

Fulgora candelaria. Linn. Fabr. Donov.

Inhabits China, from whence it is very frequently sent home in collections of insects.

GENUS CCCXCVI. FLATA. Fabr. 396. FLA-TA.

FULGORA. Latreille.

Front as if truncated, vertical, not rostrated. Eyes globulare. Elytra very broad, the external margin very much dilated. Body broad triangular.

Sp. 1. *Reticulata.* Reticula

Flata reticulata. Latr.

Inhabits Europe.

GENUS CCCXCVII. ISSUS. Fabr. 397. Is

Metabolia. Fulgora. Latr. Olivier.

Cicada. Villers.

Front as if truncated, not rostrated, vertical. Elytra at their external base very much dilated, with the apex narrower. Body short, deltoid. Eyes globular.

Coleoptratus. *Sp.* 1. *Coleoptratus.* Elytra greyish, often banded or variegated with black.

398. Cixius. Genus CCCXCVIII. Cixius. Leach.

Fulgora. Latreille.

Flata. Fabricius.

Front as if truncated, not rostrated, vertical. Elytra with the external margin nearly straight, or scarcely arcuate. Body elongate, quadrate. Eyes globular.

Nervosus. *Sp.* 1. *Nervosus.*

Flata nervosa. Fabricius.

399. Tetigometra. Genus CCCXCIX, Tetigometra. Latr.

Fulgora. Panzer.

Antennæ cylindric; second joint somewhat ovate-rounded, twice as long as the first; the apex excavated for the insertion of the third or last joint. Body ovate and depressed. Eyes triangulate.

Virescens. *Sp.* 1. *Virescens.* Yellow-green eyes; and mouth black. Feet red.

Fulgora virescens. Panzer.

Tetigometra virescens. Latr.

Inhabits France and Germany.

Family II. *Delphacida.*

Antennæ inserted in the internal sinus of the eyes, the two first joints as long, or longer than the head.

00. Asiraca. Genus CCCC. Asiraca. Latr.

Delphax. Fabricius.

Antennæ as long or longer than the thorax, the first joint very long, compressed, angulate.

Clavicornis. *Sp.* 1. *Clavicornis.* Body brown, or obscure brown variegated; apex of the four anterior tibiæ white; elytra semihyaline; apex with a fuscous band; nerves spotted with fuscous.

Delphax clavicornis. Fabr.

Asiraca clavicornis. Latr.

Inhabits France and England in grassy places.

01. Delphax. Genus CCCCI. Delphax. Fabr. Latr.

Antennæ not, or scarcely, longer than the head; the first joint much shorter than the second.

llucida. *Sp.* 1. *Pellucidà.* Body pellucid.

Delphax pellucida. Fabr.

Inhabits Europe amongst grass.

Family III. *Cercopida.*

Antennæ inserted between the eyes. Thorax not transverse, hinder margin more or less prominent.

02. Cetalion. Genus CCCCII. Cetalion. Latr.

Lystra. Fabricius.

Antennæ inserted behind the frontlet.

ticulatum. *Sp.* 1. *Reticulatum.*

Lestra reticulata. Fabricius.

3. Cercopis. Genus CCCCIII. Cercopis. Fabr. Schrank, Latr.

Cicada. Linn.

Tettigonia. Olivier.

Antennæ inserted on the frontlet, the second longer than the first joint, the third joint short conic. Thorax not dilated.

nguinolenta. *Sp.* 1. *Sanguinolenta.* Black, shining; each wing-case with a spot at the base, one in the middle, and a flexuous band at the apex blood-red.

Cicada sanguinolenta. Linn.

Cercopis sanguinolenta. Fabr.

Inhabits France, Germany, and England.

4. Ledra. Genus CCCCIV. Ledra. Fabr. Latr.

Cicada. Linn. Geoffroy. Metabolia.

Membracis. Olivier, Lamarck, Schrank.

Antennæ inserted on the frontlet, the two first joints equal in length, the first rather thickest, the third ending in a long seta. Thorax on each side dilated into an auricle.

Genus CCCCV. Membracis. Latr. 405. Membracis.

Centrotus. Fabr.

Membracis. Fabr.

Cicada. Linn.

Antennæ inserted in the frontlet; the two first joints nearly equally long; the third elongate-conic. Thorax dilated behind.

Sp. 1. *Cornutus.* Brownish. Cornutus.

Cicada cornuta. Linn.

Centrotus cornutus. Fabr.

Membracis cornuta. Latr.

Family IV. *Cicadida.*

Antennæ inserted between the eyes. Thorax transverse, hinder margin straight.

Genus CCCCVI. Iassus. Fabr. 406. Iassus.

Tettigonia. Latr. Olivier, Lamarck.

Front broad, not longer than broad, on each side above the insertion of the antennæ produced into an angle.

Sp. 1. *Lanio.* Lanio.

Cicada lanio. Panzer.

Iassus lanio. Fabr.

Tettigonia lanio. Oliv. Lamarck.

Inhabits Europe.

Genus CCCCVII. Cicada. Linn. Fabr. Latr. 407. Cicada.

Tettigonia. Olivier, Lamarck.

Front elongate-quadrate, the apex truncate, convex, thickened.

Sp. 1. *Viridis.* Viridis.

Cicada viridis. Fabricius, Panzer.

Tettigonia viridis. Latreille.

Inhabits Europe.

Tribe III. Psyllides.

Tarsi with two joints distinct. Antennæ with ten or eleven joints, the last with two setæ. Legs formed for leaping. Both sexes with wings.

Genus CCCCVIII. Psylla. Geoffroy, Olivier, Lamarck, Latreille. 408. Psylla.

Chermes. Linn. De Geer, Fabricius.

Antennæ filiform or slightly setaceous, as long as the body. Thorax with the anterior margin arcuate.

Sp. 1. *Alni.* Green-yellowish; anterior segment of the thorax, scutellum, squamula of the elytra and nerveurs green. Alni.

Chermes betulæ alni. Linn.

Chermes alni. Fabricius.

Psylla alni. Latreille.

Inhabits the alder.

Genus CCCCIX. Livia. Latreille. 409. Livia.

Diraphia. Illiger.

Antennæ shorter than the thorax, the base much thickened even to the middle. Thorax with the anterior segment transverse, straight.

Sp. 1. *Juncorum.* Juncorum.

Livia juncorum. Latreille.

Inhabits Junci.

Tribe V. Aphides.

Tarsi two-jointed; the first joint very short. Rostrum in both sexes. Antennæ with six or seven or eight joints. Females generally apterous.

FAMILY I. *Thripsida.*

Tarsi with the last joint vesiculous. Antennæ eight-jointed. Rostrum minute, horizontal, externally without joints. Head elongate quadrate.

410. THRIPS. GENUS CCCCX. THRIPS. Linn. Geoffroy, Latreille, Lamarck, Olivier.

Elytra and wings horizontal and linear.

Physapus. *Sp.* 1. *Physapus.* Black, hairy; antennæ, tibiæ and tarsi pale; middle of the tibiæ pale brown; elytra and wings white.

Thrips physapus. Linn. Fabricius, Latreille.

FAMILY II. *Aphida.*

Tarsi with the last joint with two nails. Antennæ six or seven-jointed. Rostrum very distinct, nearly perpendicular, with three distinct joints. Head transverse.

411. APHIS. GENUS CCCCXI. APHIS. Linn. Fabr. Latr. Oliv. Lam.

Antennæ setaceous or filiform, seven-jointed. Elytra larger than the wings, elongate-triangulate. Abdomen towards the apex generally tuberculated or horned. Eyes entire.

The animals of this genus are very numerous, and are found on almost every plant. The French call them *Pucerons,* the English *Plant-lice.* The species require examination. The females are generally apterous.

412. ALEYRODES. GENUS CCCCXII. ALEYRODES. Latr. Lamarck.

TINEA. Linnæus.

PHALÆNA. Geoff.

Antennæ filiform, short, six-jointed. Elytra and wings equal in size. Body mealy. Eyes two, each divided into two.

Chelidonii. *Sp.* 1 *Chelidonii.* Body yellowish, or rosy powdered with white; eyes black; each elytra with a puncture and spot of black.

TRIBE VI. APHIDES.

Tarsi with one joint and one nail. Rostrum in the female. Wings in the male, but no elytra. Female apterous.

413. DORTHESIA. GENUS CCCCXIII. DORTHESIA. Bosc. Latr.

Coccus. Dorthes, Fabr. Oliv.

Antennæ of the female eight-jointed. Abdomen of the males very setose behind.

Characias. *Sp.* 1. *Characias.*

Coccus characins. Dorthes, Fabr.

Dorthesia characias. Bosc. Latr.

Inhabits the *Euphorbium characias* of southern France.

414. COCCUS. GENUS CCCCXIV. COCCUS. Linn. Geoff. Fabr. Oliv. Latr. Lam.

Antennæ of the female eleven-jointed. Abdomen of the males with two very long setæ at the apex.

Cacti. *Sp.* 1. *Cacti.*

Coccus cacti. Linn. De Geer, Fabr. Latr.

Inhabits fruit-trees.

This genus requires a minute investigation, which should be conducted by some one possessing a great share of patience, and having a very competent knowledge of entomology.

ORDER X. APTERA.

ORDER APTERA. Linn. Delam.
ORDER SUCTORIA. Latr.

Characters of the Order.

Body somewhat ovate, compressed, covered with a coriaceous skin, and composed of several segments. Trunk short, consisting of three leg-bearing joints. Head small, compressed, rounded above, and truncate before. Eyes minute, orbicular, lateral. Antennæ lamelliform, small, ciliated with spinules, one-jointed at their base, inserted in two excavations behind the eyes. Palpi filiform (composed of four rounded joints), scarcely longer than the head, porrect, generally resting on the rostrum. Legs strong, and formed for jumping, especially the hinder ones. Coxæ and thighs large, compressed. Tarsi elongate, cylindric, composed of five simple joints, the last articulation furnished with two long, acute, slender nails.

LARVA without feet.

PUPA foliculate.

GENUS CCCCXV. PULEX, of authors. 415. PULEX.

Sp. 1. *Irritans.* Body brunneous, sometimes inclining to rust-colour.

The common bed-flea. Is found throughout Europe. Irritans.

Notwithstanding the inconveniences attending this little insect, there is something pleasing in the appearance of the flea. Its motions are elegant, and all its postures indicate agility. The shell with which it is enveloped is in a state of perpetual cleanliness, while the muscular power which it is capable of exerting is so extraordinary, as to excite our wonder, at so much strength confined and concentrated within so small a space; this species being able to spring, on the most moderate computation, to the distance of at least 200 times its own length. It is remarkable, that Socrates was ridiculed for his pretended experiments on this subject, by Aristophanes. Arist. *Clouds.* act i. scene 2. This circumstance is alluded to in Butler's *Hudibras.*

Sp. 2. *Penetrans.* The *chigger.*

Inhabits the West Indies, penetrating the human skin, and depositing a parcel of eggs within a sac. Penetra

The pulices of birds and of mammalia ought to be most carefully examined. There are a vast number of species which have been confounded with *P. irritans.*

ORDER XI. LEPIDOPTERA.

ORDER LEPIDOPTERA. Linn. Cuv. Lam. Latr.
Class GLOSSATA. Fabr.

Characters of the Order.

Wings four, covered with scales. Tongue spiral, filiform.

Linné divided this order into three genera, viz. *Papilio* (butterfly), *Sphinx* (hawk-moth), and *Phalæna* (moth), which were characterized by the form of their antennæ; and these divisions form the three great sections of Latreille, as follow.

SECTION I. DIURNA.

Wings four; all, or at least the superior ones, erect when the insect is at rest. Antennæ with their points thicker or capitate; in a very few somewhat setaceous, with the extreme apex hooked.

The insects of this section, which constituted the Linnean genus *Papilio,* all fly by day. Caterpillars with sixteen feet. Chrysalis naked, and generally angulated.

TRIBE I. PAPILIONIDES.*

Hinder tibiæ with heels only at their extremities. Antennæ not ungulated or hooked at their extremities. Wings all elevated when at rest.

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* We shall for the most part only introduce the indigenous genera, with a complete enumeration of the British species.

Family I. *Papilionida.*

Caterpillar elongate, cylindric. Chrysalis elongate, angular. Tarsi of Imago with distinct nails.

416. Papi-lio. **Genus CCCCXVI. Papilio.** Fabr. Latr. Leach.

Antennæ, at their points, furnished with a conic-ovate or lengthened-ovate, somewhat arcuate, club. Palpi very short, pressed close to the face, scarcely reaching the clypeus; the two first joints of equal length: the third minute, and nearly obsolete. Feet in both sexes alike, all being formed for walking, and furnished with distinct but simple claws. Anterior wings generally somewhat falcate; hinder ones often tailed; the internal margin excised or folded to admit of free play for the abdomen.

The caterpillar is tentaculated, fleshy, and furcate. The chrysalis angulated, with two processes before; it fastens itself by a transverse thread.

The species of this genus, which constitutes the most beautiful part of the creation, are found chiefly in the warmer regions, very few occurring in the more temperate parts of the world. Their flight is extremely rapid.

Machaon. *Sp.* 1. *Machaon.* Black and yellow; hinder wings tailed; edges of the wings black, with yellow crescents; the tips of the hinder ones with a red spot at their inferior tips.

Papilio Machaon. Linn. Fabr.

Inhabits Europe; the larva in the fennel.

In England it is called the *Swallow-tailed Butterfly*, and is very local. It is the most superb of all the British species of this family. The caterpillar is green, banded with black, marked by a row of red spots. It changes into the chrysalis state in July; and the fly is found in August. Two broods are said to be found; the first in May, having lain in the chrysalis or pupa state all the winter.

Papilio podalirius of Linné, which belongs to this genus, has been introduced into the British *Fauna*, on very dubious authority.

17. Dori-tis. **Genus CCCCXVII. Doritis.** Fabricius.

Parnassius. Latreille.

Pieris. Schrank.

Feet all alike in both sexes. Ungues or claws simple. Palpi rising above the clypeus, very prominent, cylindric-conic, with three very distinct joints. Antennæ with a thickened, somewhat ovate straight head. Hinder wings not tailed; the internal margin excised, to admit of free play for the abdomen.

The chrysalis smooth, somewhat folliculate.

pollo. *Sp.* 1. *Apollo.* Wings white, rounded, spotted with black; the lower pair marked with annular red spots.

Papilio Apollo. Gmelin.

Parnassius Apollo. Latr

Doritis Apollo. Fabr.

Inhabits Germany and France.

Larva black, spotted with red. Chrysalis brown, powdered with violet.

This elegant insect, which has been confounded by some authors with *Doritis Nemosyne* and *Phœbus*, is mentioned here in order to inform the reader, that it has no right or title whatever to a place in the British *Fauna*, although it has been described as such by Mr Harworth, and has been figured by Mr Donovan on the most vague and unsatisfactory authority.

8. Pon-tia. **Genus CCCCXVIII. Pontia.** Fabr.

Pieris. Schrank, Latr.

Antennæ elongate, with an abrupt, obconic, compressed head. Palpi slender, somewhat cylindric; the last joint as long as the preceding. Wings not very narrow, or much lengthened; hinder ones grooved to admit the abdomen, but not tailed. Feet alike in both sexes; claws unidentate or bifid.

Chrysalis angulated, fastened by a transverse thread.

* Anterior wings somewhat trigonate; hinder ones somewhat orbiculate.

Sp. 1. *Cratægi.* Wings white, with a faint tinge of yellowish and black nerveurs. Cratægi.

Papilio cratægi. Linn.

Pieris cratægi. Schrank, Latr.

Pontia cratægi. Fabr.

Inhabits Europe. In England, it is found near London, where it is called Black-veined white.

Sp. 2. *Brassicæ,* (large cabbage-butterfly). Brassicæ.

Papilio brassicæ. Linn.

Pontia brassicæ. Fabr.

Pieris brassicæ. Latr.

Inhabits Europe everywhere. The larva feeds on the cabbage.

Sp. 3. *Rapæ,* (small cabbage-butterfly). Rapæ.

Papilio rapæ. Linn.

Pontia rapæ. Fabr.

Pieris rapæ. Latr.

Inhabits Europe on cabbages.

Sp. 4. *Napi,* (green-veined white butterfly). Napi.

Papilio napi. Linn.

Pontia napi. Fabr.

Pieris napi. Latr.

Inhabits Europe everywhere.

Sp. 5. *Cardamines,* (orange-tipt butterfly). Cardamines.

Papilio cardamines. Linn.

Pontia cardamines. Fabr.

Pieris cardamines. Latr.

Inhabits Europe. The larva feeds on the *Cardamine pratensis.*

Papilio daplidice, Linn.; *Pontia daplidice,* Fabr.; *Pieris daplidice* of Latreille, has been introduced into the British catalogue, but on very slender authority.

* * Wings somewhat oval.

Sp. 6. *Sinapis.* Wings white, with blackish tips. (Wood white butterfly). Sinapis.

Papilio sinapis. Gmelin.

Pieris sinapis. Latr.

Genus CCCCXIX. Colias. Fabr. Latr. 419. Colias.

Pieris. Schrank.

Antennæ short, gradually thickening into an obconic head. Palpi much compressed; the last joint very short. Feet alike in both sexes, all with bifid, or unidentate nails. Wings anterior, somewhat trigonate; hinder rounded, with a groove to receive the abdomen.

Chrysalis angulated, fastened by a transverse thread.

Sp. 1. *Hyale,* (clouded yellow butterfly). Hyale.

Papilio Hyale of authors.

Pieris Hyale. Schrank.

Colias Hyale. Fabr. Latr.

Inhabits Europe. Occurs in England once in three years, in great plenty, in every part of the country. There is a pale coloured variety of each sex, which have been considered as distinct species.

Genus CCCCXX. Gonepteryx. Leach. 420. Gonepteryx.

Colias. Fabr. Latr.

Pieris. Schrank.

Antennæ short, gradually thickening into an obconic head. Palpi short, much compressed; the last joint very short. Feet alike in both sexes, all with a bifid or unidentate nail. Wings angulated, large, the hinder one grooved to receive the abdomen.

Metabolia. Chrysalis angulated, with a thread round its middle.

Rhamni. *Sp.* 1. *Rhamni.* Wing of the male yellow, of the female whitish; with a fulvous spot on each.
Papilio rhamni. Linn.
Colias rhamni. Fabr. Latr.
Pieris rhamni. Schrank.
Gonepteryx rhamni. Leach.
Inhabits Europe in the spring and autumn. Flight slow.

421. ARGYNNIS. GENUS CCCCXXI. ARGYNNIS. Fabr. Latr.

Antennæ terminated with a short club. Palpi divaricating abruptly, terminated with a minute, slender, acicular, very short joint; the second joint broad, hairy. Hinder wing orbicular. Anterior feet very short in both sexes. Tarsi with double nails.

Chrysalis suspended by the tail.

Caterpillars spiny.

Lathonia. *Sp.* 1. *Lathonia.*
Papilio Lathonia. Linn.
Argynnis Lathonia. Fabr.
Inhabits Europe. It is very rare in Britain.

Aglaia. *Sp.* 2. *Aglaia.*
Papilio Aglaia. Linn.
Argynnis Aglaia. Fabr.
Inhabits Europe. Is very common. *Papilio Charlotta* of Sowerby and Haworth seem to be but an accidental variety of this species.

Adippe. *Sp.* 3. *Adippe.*
Argymis Adippe. Fabr.
Inhabits heaths and the borders of woods thoughout Europe.

Paphia. *Sp.* 4. *Paphia.*
Papilio Paphia. Linn.
Argynnis Paphia. Fabr. Latr.
Inhabits the borders of woods in Germany, England, and France.

422. MELITÆA. GENUS CCCCXXII. MELITÆA. Fabr.
ARGYNNIS. Latr.

Antennæ terminated by a short club. Palpi very hairy, divaricating, with the last joint acicular, half the length of the preceding joint. Hinder wings orbicular. Anterior feet very short in both sexes. Tarsi with double nails.

Caterpillars pubescent, with fleshy tubercles.

Chrysalis suspended by the tail.

Euphrosyne. *Sp.* 1. *Euphrosyne.* (Pearly border).
Papilio Euphrosyne. Linn.
Argynnis Euphrosyne. Latr.
Melitæa Euphrosyne. Fabr.
Inhabits waste grounds and heaths.

Silene. *Sp.* 2. *Silene.* (Pearly border likeness).
Melitæa Silene. Fabr.
Inhabits the same places with the preceding species.

Cinxia. *Sp.* 3. *Cinxia.* (Glanville).
Papilio Cinxia. Gmelin.
Melitæa Cinxia. Fabr.
Argynnis Cinxia. Latr.
Inhabits Europe. Rare in Britain.

Artemis. *Sp.* 4. *Artemis.* (Greasy).
Papilio Artemis. Gmelin.
Melitæa Artemis. Fabr.
Inhabits Europe. Is common near Norwich in Norfolk.

Dictynna. *Sp.* 5. *Dictynna.* (Heath).
Papilio Dictynna. Gmelin.
Melitæa Dictynna. Fabr.
Inhabits heaths and marshes. *Papilio eos* of Haworth seems to be a variety.

Lucina. *Sp.* 6. *Lucina.* (Duke of Burgundy).
Papilio Lucina. Gmelin.
Melitæa Lucina. Fabr.
Inhabits borders of woods and hedges.

423. VANESSA. GENUS CCCCXXIII. VANESSA. Fabricius, Latreille.

Antennæ terminated with an abrupt short club. Palpi contiguous and terminated gradually in a point; the two combined bearing some resemblance to a rostrum. Anterior pair of feet in both sexes short and very hairy. Tarsi with double nails. Chrysalis suspended by its tail. Caterpillar spiny.

Atalanta *Sp.* 1. *Atalanta.* (Red admirable.)
Papilio Atalanta. Linn.
Vanessa Atalanta. Fabricius, Latreille.
Inhabits Europe. The larva on nettles.

Cardui. *Sp.* 2. *Cardui.* (Painted lady.)
Papilio cardui. Linn.
Vanessa cardui. Fabricius, Latreille.

Antiop *Sp.* 3. *Antiopa.* (Camberwell beauty.)
Papilio Antiopa. Linn.
Vanessa Antiopa. Latreille.
Inhabits Europe. The English variety has invariably a white margin to the wings.

Io. *Sp.* 4. *Io.* (Peacock.)
Papilio Io. Linn.
Vanessa Io. Fabricius, Latreille.
Inhabits the nettle.

Polychlo ros. *Sp.* 5. *Polychloros.* (Large tortoise-shell.)
Papilio Polychloros. Linn.
Vanessa Polychloros. Fabricius.
Inhabits Europe. The larva on the elm.

Urticæ *Sp.* 6. *Urticæ.* (Small tortoise-shell.)
Papilo urticæ. Linn.
Vanessa urticæ. Latreille, Fabricius.
Inhabits Europe.

C-albu *Sp.* 7. *C-album.* (Comma.)
Papilio c-album. Linn.
Vanessa c-album. Fabricius.

424. H parchi GENUS CCCCXXIV HIPPARCHIA. Fabricius, Leach.
MANIOLA. Schrank.
SATYRUS. Latreille.

Antennæ with a slender somewhat fuciform or somewhat trigonate orbicular club. Palpi meeting above the tongue, with the second joint very much compressed, and very much longer than the first. Anterior pair of legs shorter than the rest, and often very hairy; feet of the other legs with double nails. Hinder wings somewhat orbicular or orbiculate-triangulate, with the internal margin excavated to receive the abdomen; the middle cell closed behind, from which part the nervures radiate; the other margin entire, or with acute or obtuse indentations. Caterpillar downy, with a globular head somewhat compressed in front; the abdomen bimucronate behind. Chrysalis angulated, with the front bimucromate suspended by the tail. Leach's *Zoolog. Miscel.* vol. i. p. 27.

Galat *Sp.* 1. *Galathea.* (Marbled.)
Papilio Galathea. Linn. Gmelin.
Hipparchia Galathea. Fabricius.
Satyrus Galathea. Latreille.
Inhabits Europe in fields.

Hype thus *Sp.* 2. *Hyperanthus.* (Eyed.)
Papilio Hyperanthus. Linn.
Hipparchia Hyperanthus. Fabr.
Satyrus Hyperanthus. Latreille.
Inhabits Europe in fields.

Pam *Sp.* 3. *Pamphilus.* (Heath.)
Papilio Pamphilus. Linn. Gmelin.
Hipparchia Pamphilus. Fabricius.
Satyrus Pamphilus. Latreille.

Metabolia.

Inhabits heaths.

Blandina.

Sp. 4. *Blandina.* (Scotch argus.)
Papilio Blandina. Donovan.
Inhabits the isles of Bute and Arran. The male has been confounded with *Hipparchia Ligea* of Fabricius, to which species it is very dissimilar.

Pilosellæ.

Sp 5. *Pilosellæ.* (Small meadow brown.)
Papilio Pilosellæ. Gmelin.
Hipparchia Pilosellæ. Fabricius.
Satyrus Pilosellæ. Latreille.
Inhabits fields and the borders of woods.

Janira.

Sp. 6. *Janira.*
Papilio Janira. Linn.
Papilio Jurtina. Linn.
Hipparchia Janira. Fabricius.
Satyrus Janira. Latreille.
Inhabits fields.

Megæra.

Sp. 7. *Megära.* (Gate-keeper.)
Papilio Megära. Gmelin
Hipparchia Megära. Latreille.
Inhabits fields and the borders of woods.

Ægeria.

Sp. 8 *Ægeria.* (Wood argus.)
Papilio Ægeria. Linn. Gmelin.
Hipparchia Ægeria. Fabricius.
Inhabits borders of woods and fields.

mele.

Sp. 9. *Semele.*
Papilio Semele. Gmelin.
Hipparchia Semele. Fabricius.
Inhabits heaths and rocky wastes.

Obs. Besides the species of this genus here enumerated, there are others which have been taken in this country, viz. 1. *Papilio Hero* of Donovan; 2. *Papilio Typhon*; and, 3. *Papilio Daaus* of Haworth: But as these names are probably wrongly assigned to these insects, we shall say nothing more on the subject, but leave this point to be ascertained by the investigations of the reader.

Limenitis.

GENUS CCCCXXV. LIMENITIS. Fabricius.
NYMPHALIS. Latreille.

Antennæ gradually clubbed; club slender, round-obconic. Palpi as long as the head, with the second joint not very compressed; the anterior margin not remarkably broader. Anterior pair of feet in both sexes very short and spurious. Wings not much longer than broad Four hinder feet with double nails. Larva elongate. Chrysalis suspended by the tail.

milla.

Sp. 1. *Camilla.* (White admirable.)
Papilio Camilla. Linn. Gmelin.
Limenitis Camilla. Fabricius.
Nymphalis Camilla. Latreille.
Inhabits Europe. Is rare in Britain, except in Charlton wood, Kent, where it is found in great plenty.

Apatura.

GENUS CCCCXXVI. APATURA. Fabricius.
NYMPHALIS. Latreille.

Antennæ with an elongate-obconic thickened club. Palpi with the second joint not much compressed, the anterior margin broad. Anterior pair of feet very short in both sexes.

Sp. 1. *Iris.* (Purple emperor.)
Papilio Iris. Donovan, Haworth.
Apatura Iris. Fabricius?
Nymphalis Iris. Latreille.
Inhabits England.

This beautiful insect is called wood emperor, emperor of Morocco, &c.

FAMILY II. *Lycænida.*

Larva oval, depressed. Pupa or chrysalis short, contracted, obtuse at both extremities. Tarsi with very small nails.

Metabolia.

427. Thecla.

GENUS CCCCXXVII. THECLA. Fabr.
POLYOMMATUS. Latr.

Feet in both sexes all alike; nails scarcely produced beyond the pulvilli, which are large. Antennæ gradually clubbed; the club elongate, cylindric oval. Hinder wings tailed.

Betulæ.

Sp. 1. *Betulæ.* (Brown hair streak.)
Papilio betulæ. Gmelin.
Thecla betulæ. Fabr.
Polyommatus betulæ. Latr.
Inhabits Europe, frequenting the borders of woods.

Pruni.

Sp. 2. *Pruni.* (Black hair-streak).
Papilio pruni. Hübner.
Thecla pruni. Fabr.
Inhabits borders of woods.

Quercus.

Sp. 3. *Quercûs.* (Purple hair-streak).
Papilio quercûs. Gmelin.
Thecla quercûs. Fabr.
Polyommatus quercûs. Latr.
Inhabits oak woods, flying on the highest branches of the trees.

428. Lycæna.

GENUS CCCCXXVIII. LYCÆNA. Fabr.
POLYOMMATUS. Latr.

Legs alike in both sexes; nails projecting beyond the pulvilli, which are small. Antennæ with an abrupt club, somewhat ovate, or somewhat oval.

* Hinder wings more or less tailed.

Dispar.

Sp. 1. *Dispar.* (Large copper).
Papilio dispar. Haworth.
Papilio Hypothöe. Donovan.
Inhabits the fens of Cambridgeshire, and has been observed near Aberdeen in Scotland.

Chryseis.

Sp. 2. *Chryseis.* (Purple-edged copper).
Lycæna Chryseis. Fabr.
Inhabits Europe. In Britain it is extremely rare.

Virgaureæ.

Sp. 3. *Virgaureæ.* (Scarce copper).
Lycæna virgaureæ. Fabr.
Polyommatus virgaureæ. Latr.
Papilio virgaureæ. Gmelin.
Inhabits Europe. Very local in Britain. It is found in some parts of Huntingdonshire.

Phlæas.

Sp. 4. *Phlæas.* (Small copper).
Lycæna Phlæas. Fabr.
Polyommatus Phlæas. Latr.
Inhabits Europe; much attached to syngenesious plants.

Rubi.

Sp. 5. *Rubi.* (Green underside).
Papilio rubi. Gmelin.
Lycæna rubi. Fabr.
Polyommatus rubi. Latr.
Inhabits Europe.

* * Hinder wings with the posterior margin entire.

Corydon.

Sp. 6. *Corydon.* (Chalk-hill blue).
Papilio Corydon. Linn. Gmelin.
Lycæna Corydon. Fabr.
Polyommatus Corydon. Latr.
Inhabits chalky districts.

Adonis.

Sp 7. *Adonis.* (Clifden blue).
Papilio Adonis. Linn. Gmelin.
Lycæna Adonis. Fabr.
Inhabits chalky districts.

Dorylas.

Sp. 8. *Dorylas.* (Common blue).
Papilio Dorylas. Gmelin?
Papilio Icarus. Lewin.
Inhabits Europe everywhere.

Argus.

Sp. 9. *Argus.* (Studded blue).

Papilio Argus. Gmelin.
Lycæna Argus. Fabr.
Polyommatus Argus. Latr.
Inhabits fields and marshes.

Idas. *Sp.* 10. *Idas.* (Black-spot brown).
Papilio Idas. Gmelin.
Lycæna Idas. Fabr.
Inhabits Europe.

Artaxerxes. *Sp.* 11. *Artaxerxes.* (White-spot brown).
Papilio Artaxerxes. Gmelin, Stewart.
Lycæna Artaxerxes. Fabr.
Inhabits Arthur's Seat, and the base of Kirk-hill, one of the Pentland range, near Edinburgh, in great plenty.

Alsus. *Sp.* 12. *Alsus.* (Bedford blue).
Papilio Alsus. Gmelin.
Lycæna Alsus. Fabr.
Polyommatus Alsus. Latr.
Inhabits Europe.

Argiolus. *Sp.* 13. *Argiolus.* (Azure blue).
Papilio Argiolus. Gmelin.
Inhabits meadows.

Cymon. *Sp.* 14. *Cymon.*
Papilio Cymon. Gmelin, Lewin.
Inhabits Europe. In Britain it is very local. It is found near Sherborne in Dorset, in great abundance.

Tribe II. Hesperides.

Hinder tibiæ with two pair of heels or spurs, one pair at the middle, the other at the usual place. Antennæ hooked at their extremities. Hinder wings elevated when the insect is at rest.

Family I. *Uranida.*

Antennæ filiform, their points narrower and bent. Palpi long, slender.

429. Urania. Genus CCCCXXIX. Urania. Fabr. Latr.
Papilio. Linn. Crammer.
Palpi with the second joint much compressed, the third slender, somewhat cylindric, almost naked.

Leilus. *Sp.* 1. *Leilus.*
Papilio Leilus. Linn.
Urania Leilus. Fabr.

Family II. *Hesperida.*

Antennæ distinctly terminated with a club. Palpi short, thick, and squamose in front.

430. Hesperia. Genus CCCCXXX. Hesperia. Fabr. Cuv. Lam. Latr. Walck.
Papilio. Linn.
Palpi with the third joint cylindric, or cylindric-conic.

* Antennæ ending in an abrupt, very acute hook.

Comma. *Sp.* 1. *Comma.* (Pearl skipper).
Papilio Comma. Gmelin.
Hesperia Comma. Fabr. Latr.
Inhabits Europe. In England, near Lewes, in Sussex.

Sylvanus. *Sp.* 2. *Sylvanus.* (Wood-skipper).
Papilio Sylvanus. Gmelin.
Hesperia Sylvanus. Fabr. Latr.
Inhabits the borders of woods.

* * Antennæ with their points arcuate.

Tages. *Sp.* 3. *Tages.* (Dingy skipper).
Papilio Tages. Gmelin.
Hesperia Tages. Fabr. Latr.
Inhabits Europe, on dry heaths and banks.

Malvæ. *Sp.* 4. *Malvæ.* (Mallow skipper).
Papilio malvæ. Gmelin.
Hesperia malvæ. Fabr. Latr.
Inhabits dry banks.

* * * Antennæ with straight points.

Linea. *Sp.* 5. *Linea.* (Small skipper).
Hesperia linea. Fabr. Latr.
Papilio linea. Gmelin.
Inhabits the margins of woods.

Paniscus. *Sp.* 6. *Paniscus.* (Scarce skipper).
Papilio Paniscus. Gmelin.
Hesperia Paniscus. Latr. Fabr.
Inhabits meadows. Very rare in Britain, excepting in some parts of Bedfordshire, where it is common.

Sect. II. Crepuscularia.

Wings horizontal in repose. Antennæ prismatic or fusiform.

The insects of this tribe constitute the Linnean genus *Sphinx*, which has been divided by Fabricius, Latreille, Scopoli, and Hoffmansegg, into a number of genera.

Tribe I. Sphingides.

Palpi short, covered with very short, close scales; the last joint tuberculiform and very short.

431. Laothöe. Genus CCCCXXXI. Laothöe. Fabr.
Sphinx. Linn.
Spectrum. Scopoli.
Smerinthus. Latr.
Antennæ somewhat prismatic, serrated towards the middle, gradually thicker. Tongue very short. Anterior wings angulated. Palpi contiguous.

Ocellata. *Sp.* 1. *Ocellata.* (Eyed hawk-moth).
Sphinx ocellata. Linn.
Laothöe ocellata. Fabr.
Spectrum ocellatum. Scopoli.
Smerinthus ocellatus. Latr.
Inhabits Europe. The larva in the willow and poplar.

Tiliæ. *Sp.* 2. *Tiliæ.* (Lime hawk-moth).
Sphinx tiliæ. Linn. Gmelin.
Laothöe tiliæ. Fabr.
Spectrum tiliæ. Scopoli.
Smerinthus tiliæ. Latreille.
Inhabits the lime in the caterpillar state.

Populi. *Sp.* 3. *Populi.* (Poplar hawk-moth).
Sphinx populi. Linn. Gmelin.
Laothöe populi. Fabr.
Spectrum populi. Scopoli.
Smerinthus populi. Latr.
Inhabits Europe. The larva on poplars and willows.

432. Sphinx. Genus CCCCXXXII. Sphinx. Linn. Fabr. Latreille.
Spectrum. Scopoli.
Palpi contiguous above the tongue. Tongue long, very distinct, convoluted. Antennæ prismatic, thicker towards their middle, in the males slightly ciliated. Abdomen with the anus not bearded.

Porcellus. *Sp.* 1. *Porcellus.* (Small elephant hawk-moth.)
Sphinx porcellus. Gmelin, Fabricius, Latreille.
Inhabits Europe. Is rare in Britain.

Elpenor. *Sp.* 2. *Elpenor.* (Elephant hawk-moth.)
Sphinx Elpenor. Linn. Latreille, Fabricius, Gmelin.
Inhabits Europe.

Lineata. *Sp.* 3. *Lineata.* (Silver line hawk-moth.)
Sphinx lineata. Linn.
Inhabits Europe. *Obs. Sphinx Lineata* of Donovan

is distinct, and must be considered as a doubtful inhabitant of Britain.

Sp. 4. *Galii.* (Scarce spotted elephant.)
Sphinx galii. Fabricius.
Inhabits Europe. Four specimens only have hitherto been taken in Great Britain; two in Cornwall near Penzance, one near Kingsbridge in Devon, and another near London.

Sp. 5. *Euphorbiæ.* (Spotted elephant.)
Sphinx euphorbiæ. Gmelin, Fabricius, Latreille.
Inhabits Europe. It is very rare in Britain. The larva has occurred near Plymouth.

Sp. 6. *Pinastri.* (Pine hawk-moth.)
Sphinx pinastri. Fabricius, Gmelin.
Inhabits Europe. It has been taken near London, and in Ravelston wood near Edinburgh.

Sp. 7. *Convolvuli.* (Convolvulus hawk-moth.)
Sphinx convolvuli. Linn. Fabricius, Latreille.
Inhabits Europe. It has been taken in the most remote parts of Great Britain, even in the Shetland Islands, but does not make a regular appearance.

Sp. 8. *Ligustri.* (Privet hawk-moth.)
Sphinx ligustri. Fabricius, Gmelin.
Inhabits Europe. The larva feeds on the privet and ash.

Sp. 9. *Atropos.* (Death's head hawk-moth.)
Sphinx Atropos. Linn. Gmelin, Fabricius, Latr.
Spectrum Atropos. Scopoli.
Inhabits Europe. It must be considered as a valuable acquisition to the British cabinet, for although it be very common in the caterpillar state, yet is it bred with extreme difficulty; and the fly when taken on the wing is generally very much mutilated and rubbed. The caterpillar occurs in potatoe fields, and is said also to feed on the jasmine leaves.

The death's head hawk-moth is distinguished by a remarkable spot on its thorax, bearing a slight resemblance to a skull. From this circumstance, and that of its uttering a sharp sound when handled, it has been considered, by the vulgar, as an animal of ill omen, and as a messenger of fate. The members of a female convent, (as we learn from Reaumur,) were thrown into great consternation on discovering one of these insects, which had accidentally flown in at one of the open windows during the evening.

GENUS CCCCXXXIII. SESIA. Fabricius.
SPHINX. Linn. Latreille.
MACROGLOSSUM. Scopoli.
Palpi contiguous above the tongue. Tongue very long, distinct and convoluted. Antennæ prismatic, thicker towards their middle, (of the males ciliated.) Abdomen with the anus tufted.

* Wings opaque.

Sp. 1. *Stellatarum.* (Humming-bird hawk-moth.)
Sphinx stellatarum. Linn. Gmelin, Latreille.
Sesia stellatarum. Fabricius.
Macroglossum stellatarum. Scopoli.
Inhabits Europe. The perfect insect feeds, in the wing, on the honey of stellated plants.

** Wings transparent.

Sp. 2. *Bombyciformis.* (Narrow bordered bee-hawk-moth.)
Sphinx fusiformis. Linn.
Sesia bombyciformis. Fabricius.
Inhabits Europe, on the borders of woods.

Sp. 3. *Fusiformis.* (Broad-bordered bee-hawk-moth.)
Sesia fusiformis. Fabricius.
Sphinx fusiformis. Gmelin.
Inhabits Europe, on the borders of woods.

TRIBE ZYGÆNIDES.

Metabolia.

Palpi long, separate, covered with long scales, or porrected hair.

GENUS CCCCXXXIV. ÆGERIA. Fabricius. 434. ÆGERIA.
SESIA. Latreille, Laspeyres.
TROCHILUM. Scopoli.
Antennæ fusiform. Abdomen with the anus bearded.

Sp. 1. *Apiformis.* (Bee hornet-sphinx.) Apiformis.
Sesia apiformis. Latreille.
Ægeria apiformis. Fabricius.
Trochilum apiforme. Scopoli.
Sphinx apiformis. Linn.
Inhabits Europe.

Sp. 2. *Craboniformis.* (Hornet-sphinx.) Craboniformis.
Sesia craboniformis. Fabricius.
Inhabits Europe.

Sp. 3. *Vespiformis.* (Wasp hornet-sphinx.) Vespiformis.
Sphinx chrysorrhea. Donovan.
Inhabits Europe.

Obs. There are several other species of this genus found in Britain, but their synonyms have never been satisfactorily ascertained. We may add one more, viz.

Sp. 4. *Tipuliformis.* (Currant hornet-sphinx.) Tipuliformis.
Sphinx tipuliformis. Gmelin.
Sesia tipuliformis. Latreille.
Inhabits gardens. The larvæ perforate and destroy the currant bushes, and where they are plenty produce a serious mischief.

GENUS CCCCXXXV. ZYGÆNA. Fabricius. 435. ZYGÆNA.
SPHINX. Linn.
Antennæ abruptly flexuous-clavate. Palpi cylindric, conic.

Sp. 1. *Filipendulæ.* (Six-spot burnet.) Filipendulæ.
Sphinx filipendulæ. Linn.
Zygæna filipendulæ. Fabricius, Latreille.
Inhabits fields.

Obs. There is another species having but five red spots on the anterior wings, which is distinct, and is generally referred to the *Zygæna loti* of Fabricius.

GENUS CCCCXXXVI. INO. Leach. 436 INO.
PROCRIS. Fabricius, Latreille.
ZYGÆNA. Panzer, Walckenaer.
SPHINX. Linn.
Antennæ of the male bipectinate, of female simple. Palpi short.

Sp. 1. *Statices.* (Forrester.) Statices.
Sphinx statices. Linn.
Zygæna statices. Rossi, Panzer.
Procris statices. Fabricius, Latreille.
Ino statices. Leach.
Inhabits the margins of woods in meadows.

SECTION III. NOCTURNA.

Wings horizontal in repose. Antennæ setaceous, gradually narrowing towards their extremities.

TRIBE I. BOMBYCIDES.

Antennæ of the male at least serrated. Tongue none. Palpi two, short, cylindric, very hairy. Thorax not crested. Wings undivided.

FAMILY I. *Cossida.*

Antennæ with a single series of ciliæ. Wings elongate.

Obs. The larvæ of this family generally live on the solid wood of trees, which they perforate in every direction. Sides of the chrysalis denticulated.

GENUS CCCCXXXVII. HEPIALUS. Fabr. Latr. 437. HEPIALUS.
PHALÆNA (*Noctua.*) Linn.
Antennæ moniliform, shorter than the thorax. Pal-

pi very small, and very hairy. Wings elliptic, equal, long.

Humuli.

Sp. 1. *Humuli.* (Ghost-swift.)
Noctua humuli. Linn.
Hepialus humuli. Fabricius, Latreille.
Inhabits fields.

Mappa.

Sp. 2. *Mappa.* (Map-wing swift.)
Phalæna mappa. Donovan.
Inhabits Britain. Has been taken near Dunstar castle, in Somerset, by Mr G. Sowerby. It may be synonymous with *Bombyx velleda* of Hübner.

Hectus.

Sp. 3. *Hectus.* (Golden swift.)
Phalæna noctua hecta. Gmelin.
Hepialus hectus. Fabricius.
Inhabits Europe.

Obs. We have in Britain several other species, but their characters are evanescent, and their names have never been determined with accuracy.

438. Cossus.

GENUS CCCCXXXVIII. COSSUS. Fabricius, Latreille, Cuvier.
PHALÆNA BOMBYX. Linn.

Antennæ as long as the thorax, setaceous, furnished with a single series of short transverse obtuse teeth. Palpi very distinct, thick, cylindric, and squamous. Anterior wings larger than the posterior.

Ligniperda.

Sp. 1. *Ligniperda.* (Goat-moth.)
Phalæna (Bombyx) *Cossus*, Linn.
Cossus ligniperda. Fabricius, Latreille.
Inhabits Europe. The larva feeds on the internal parts of the willow and ash. The celebrated Lyonett has immortalized himself by his laborious work on the anatomy of the larva, and perfect insect. The caterpillar diffuses a scent, by which its residence may frequently be made known to those passing such trees as are much infested by it. It remains three years in this state, when it spins a strong web, intermixed with particles of wood, and changes into the chrysalis, which it does in the month of May, and in June the perfect insect starts into existence.

439. Zeuzera.

GENUS CCCCXXXIX. ZEUZERA. Latreille.
BOMBYX. Hübner.
HEPIALUS. Schrank.
PHALÆNA, (NOCTUA.) Linn.
COSSUS. Fabricius.

Antennæ setaceous, (in the male pectinated to the middle.

Æsculi.

Sp. 1. *Æsculi.* (Wood-leopard moth.)
Cossus æsculi. Fabricius.
Bombyx æsculi. Hubner.
Zeuzera æsculi. Latreille.
Phalæna æsculi. Linn.
Inhabits Europe. In England it is rather rare, but may be found in St James's Park, in July, if industriously sought after.

FAMILY II. *Bombycida.*

Antennæ of the males with a double series of pectinations.

Obs. The larvæ of this family live on the leaves of trees. Sides of the chrysalis not serrated or denticulated.

440. Saturnia.

GENUS CCCCXL. SATURNIA. Schrank.
PHALÆNA, (ATTACUS.) Linn.
BOMBYX. Fabricius, Hubner, Latreille.

Wings horizontal. Antennæ with the second joint (in the male) bidentate. Caterpillar naked, elongate, with the anal feet distinct, and resembling the middle ones.

Pavonia minor.

Sp. 1. *Pavonia minor.* (Emperor moth.)
Phalæna attacus pavonia minor. Linn.
Bombyx pavonia minor. Fabricius.
Inhabits Europe.

441. Lasiocampa.

GENUS CCCCXLI. LASIOCAMPA. Schrank.
BOMBYX. Fabricius, Latreille.

Superior wings deflexed; inferior ones reversed. Antennæ of the male very much pectinated. Palpi not produced into a rostrum. Caterpillar naked, elongate, with the anal feet distinct, and resembling the middle ones.

Quercûs.

Sp. 1. *Quercûs.* (The egger moth.)
Phalæna bombyx quercûs. Linn.
Bombyx quercûs. Fabricius, Latreille.
Inhabits Europe. The larva feeds on the bramble.

Obs. The following indigenous species of Fabrician *Bombyx* are referable to this genus, viz. 2. *Trifolii*; 3. *Rubi*; 4. *Cratægi*; 5. *Neustria*; 6. *Populi*; 7. *Lanestris.* The four last are distinguished by their palpi, being more hairy than the rest, and may be considered as forming a subdivision.

442. Bombyx.

GENUS CCCCXLII. BOMBYX. Fabr. Latr. Schrank.

Superior wings deflexed, inferior ones reversed. Antennæ of the male very much pectinated. Palpi produced into a rostrum. Caterpillar naked, with the anal feet like the middle ones distinct.

Quercifolia.

Sp. 1. *Quercifolia,* (lappet moth.)
Phalæna bombyx quercifolia. Linn.
Bombyx quercifolia. Fabr. Latr.
Inhabits Europe.

Obs. The following indigenous *Bombyces* of Fabricius belong to this genus, viz. 2. *Potatoria*; 3. *Pini.*

443. Laria.

GENUS CCCCXLIII. LARIA. Schrank.
PHALÆNA (BOMBYX.) Linnæus.
BOMBYX. Latreille, Fabricius.

Wings deflexed, the under ones entirely covered by the upper ones. Antennæ of the male much pectinated, or much ciliated. Caterpillar naked; the hinder feet distinct like the middle ones.

Dispar.

Sp. 1. *Dispar,* (gipsey moth).
Phalæna dispar. Linnæus.
Bombyx dispar. Fabricius.
Inhabits Europe.

Obs. This genus requires examination. The following species are found in Britain: 2. *Monacha,* (black arches); 3. *Fascelina,* (scarce tussock); 4. *Pudibunda,* (common tussock); 5. *Reclusa,* (small chocolate-tip); 6. *Curtula?* (large chocolate-tip); 7. *Roboris*; 8. *Trimacula,* (Donovan); 9. *Cæruleocephala,* (figure of eight;) 10. *Coryli,* (nut-tree tussock); 11. *Ziczac,* (pebble prominent); 12. *Dromedarius,* (iron prominent); 13. *Bucephala,* (buff-tip); 14. *Tritophus,* (aspen prominent); 15. *Trepida,* (swallow prominent); with a few other species whose names are not yet determined. *Bombyx visicolora* of Fabricius, (the Kentish glory,) forms a peculiar genus, viz. *Dorvillia.* Leach.

444. Cerura.

GENUS CCCCXLIV. CERURA. Schrank.
BOMBYX. Fabricius, Latreille.
PHALÆNA, (BOMBYX.) Linnæus.

Antennæ in both sexes pectinated, and gradually acuminate. Caterpillar, with the anal feet transformed into a furcate tail.

Vinula.

Sp. 1. *Vinula,* (puss moth.)
Phalæna bombyx vinula. Linnæus.
Bombyx vinula. Fabricius, Latreille.
Cerura vinula. Schrank.
Inhabits Europe. The larva feeds in willows and poplars.

Furcula.

Sp. 2. *Furcula,* (kitten moth.)
Bombyx furcula. Latreille, Fabricius.
Inhabits Europe; not common in Britain.

Metabolia.

TRIBE II. ARCTIDES.

Noctuo-Bombycites. Latreille.

Palpi two. Antennæ pectinated, or ciliated. Tongue visible, but often short, and somewhat membranaceous. Wings trigonate, deflexed, undivided. Caterpillar with sixteen feet.

445. Arctia.

GENUS CCCCXLV. ARCTIA. Schrank, Latreille.
BOMBYX. Fabricius.

Palpi with long scales. Antennæ of the males (at least) with a double series of pectinations. Tongue often short, composed of two separate filaments.

* Antennæ ciliated.

Villica.

Sp. 1. *Villica,* (cream spot tyger).
Bombyx villica. Fabricius.
Inhabits Europe.

Obs. The other indigenous species of this division, are, 2. *Caja,* (tyger moth); 3. *Plantaginis*; 4. *Russula,* (clouded buff); 5. *Mendica,* (muslin); 6. *Methrastri,* (ermine); 7. *Papyritia,* (water ermine); 8. *Lubricipeda,* (buff ermine).

** Antennæ pectinated.

Salicis.

Sp. 1. *Salicis,* (satin moth).
Arctia salicis. Latreille.
Inhabits Europe. The larva on willows and poplars.

Chrysorrhæa.

Sp. 2. *Chrysorrhæa,* (golden tail moth).
Bombyx chrysorrhæa. Fabricius.
Inhabits Europe.

hæorrhæa.

Sp. 3. *Phæorrhæa,* (brown tail moth).
Bombyx phæorrheæ. Haworth.
Bombyx chrysorrhæa. Hübner.
Inhabits Europe. This is the species whose larva commits such destruction amongst white thorn hedges, as mentioned in our history of entomological dissertations.

46. Callimorpha.

GENUS CCCCXLVI. CALLIMORPHA. Latreille.
BOMBYX. Fabricius.
LOTHOSIA. Fabricius.

Palpi with short, not porrect scales. Antennæ simple, or slightly ciliated. Tongue long, the two filaments conjoined.

minula.

Sp. 1. *Dominula,* (scarlet tyger moth.)
Bombyx dominula. Fabricius.
Callimorpha dominula. Latreille.
Inhabits Europe.

Obs. Bombyx, 2. *Rosea* (red arches); 3. *Jacobeæ,* (cinnebar); are referable to this genus.

TRIBE III. TINEIDES.

Antennæ setaceous, simple. Tongue distinct. Palpi two, cylindric. Wings long, oblong, somewhat elliptic, incumbent or convolute, inferior ones much folded, all undivided.

FAMILY I. *Tineida.*

Antennæ distant from each other. Eyes separate, divided by a frontlet.

DIVISION I.

Tongue distinct, elongate. Front not very hairy.

Li- sia.

GENUS CCCCXLVII. LITHOSIA. Fabr. Latr.

Wings horizontal. Palpi shorter than the head, last joint cylindric, distinctly shorter than the second. Back much flattened. Antennæ simple, or but slightly ciliated.

dra.

Sp. 1. *Quadra,* (four-spotted footman).
Phalæna quadra. Linn.
Lithosia quadra. Fabricius, Latreille.
Inhabits Europe.

The other indigenous species are, 2. *Complana*; 3. *Rubricollis*; 4. *Irrorata*; with three species not yet ascertained.

Metabolia.

448. Yponomeuta.

GENUS CCCCXLVIII. YPONOMEUTA. Latreille.
PHALÆNA, (TINEA). Linnæus.
TINEA. Fabricius, Hübner.

Wings rolled, or convoluted. Palpi as long as the head, the third joint obconic, as long or longer than the one before it. Antennæ simple.

Evonymella.

Sp. 1. *Evonymella.*
Phalæna evonymella. Linnæus.
Tinea evonymella. Fabricius.
Yponomeuta evonymella. Latreille.
Inhabits Europe.

449. Nemapogon.

GENUS CCCCXLIX. NEMAPOGON. Schrank.
PHALÆNA (TINEA). Linnæus.
TINEA. Fabricius.
ALUCITA. Olivier.
ÆCOPHORA. Latreille.

Wings broadly fringed, lying on the back. Palpi twice as long or more than the body; the second joint longer than the head, the last joint almost naked, recurved beyond the head.

Obs. To this genus *Tinea,* 1. *Linneella*; 2. *Flavella*; 3. *Roesella,* and their congeners, belong.

DIVISION II.

Tongue not distinct, very short. Front very hairy.

450. Euplocamus.

GENUS CCCCL. EUPLOCAMUS. Latreille.
TINEA. Fabricius.
PYRALIS. Hubner.

Palpi two; the second joint with numerous elongate scales, the third joint naked and ascending. Antennæ much pectinated.

Guttella.

Sp. 1. *Guttella.*
Tinea guttella. Fabricius.
Euplocamus guttellus. Latr.
Inhabits Europe.

451. Tinea.

GENUS CCCCLI. TINEA. Latr. Fabr. Hübner.
PHALÆNA (TINEA). Linnæus.

Palpi four, distinct, upper ones small, inflexed. Antennæ simple, or slightly ciliated.

Pelionella.

Sp. 1. *Pelionella,* (cloth's moth).
Tinea pelionella. Fabr. Latr.
Phalæna tinea pelionella. Linnæus.
Inhabits houses.

Obs. All the cloth moths, of which there are several species, belong to this genus.

FAMILY II. *Nemophorida.*

Antennæ inserted very near to each other. Eyes nearly meeting behind.

452. Nemophora.

GENUS CCCCLII. NEMOPHORA. Hoffmansegg.
ADELA. Latreille.
NEMAPOGON. Schrank.
ALUCITA. Fabricius.
TINEA. Hübner.
PHALÆNA (TINEA). Linnæus.

Degeerella.

Sp. 1. *Degeerella,* (Japan moth).
Phalæna tinea Degeerella. Gmelin.
Adela Degeerella. Latreille.
Inhabits the borders of woods.

Obs. All the long-horned Japan moths, as they are called by English collectors, belong to this genus.

TRIBE IV. NOCTUIDES.

Antennæ setaceous, in the males sometimes pectinated or ciliated. Tongue distinct. Palpi much compressed. Wings horizontal or incumbent, not divided. Thorax thick, often crested.

Metabola.

FAMILY I. *Erebida.*

Palpi with the last joint as long or longer than the preceding.

453. Erebus. GENUS CCCCLIII. EREBUS. Latreille.

NOCTUA. Fabricius.

Wings expanded.

Odorus. *Sp.* 1. *Odorus.*

Noctua odora. Fabricius.

Erebus odorus. Latreille.

FAMILY II. *Noctuida.*

Palpi with the last joint much shorter than the preceding, squamous.

454. Noctua. GENUS CCCCLIV. NOCTUA. Fabr. Latr. Hübner.

BOMBYX. Fabricius, Hübner.

PHALÆNA (BOMBYX). Linnæus.

PHALÆNA (NOCTUA). Linnæus.

PÆCILIA. Schrank.

CUCULLIA. Schrank.

Obs. The genus *Noctua* requires a minute investigation. It contains several very natural genera, as exhibited in the following divisions:

A. Caterpillar with sixteen feet.

* Caterpillars half-loopers, their anterior feet membranaceous, evidently shorter than the others. Wings horizontal.

Fraxini. *Sp.* 1. *Fraxini,* (clifden nonpareil).

Noctua fraxini. Fabricius, Latreille.

Sponsa. *Sp.* 2. *Sponsa,* (crimson underwing).

Noctua sponsa. Fabricius, Latreille.

To this Section *Noctua,* 3. *Nupta*; 4. *Promissa*; 5. *Pacta*; 6. *Maura,* &c. belong.

** Caterpillars with membranaceous feet of conformable size.

1. Wings horizontal.

Fimbria. *Sp.* 1. *Fimbria,* (broad bordered yellow underwing moth).

Noctua fimbria. Fabricius.

Pronuba. *Sp.* 2. *Pronuba,* (yellow underwing); 3. *Orbona*; 4. *Janthina,* &c.

2. Wings deflexed.

a. Sp. 1. *Rumicis,* (common knot grass moth); 2. *Psi,* (dagger moth), &c.

b. Sp. 1. *Ligustri,* (coronet); 2. *Pisi,* (broom moth), &c.

c. Sp. 1. *Verbasci*; 2. *Tanaceti,* &c.

d. Sp. 1. *Batis,* (peach blossom moth).

e. Sp. 1. *Meticulosa,* (angle shades).

f. Sp. 1. *Palpina,* (pale prominent moth).

g. Sp. 1. *Camelina.*

B. Caterpillar with fourteen feet.

Sp. 1. *Chrysitis,* (burnished brass moth); 2. *Festucæ,* (gold spot moth), &c.

TRIBE V. PHALÆNIDES.

Antennæ approximating at their base; those of the male often pectinated or ciliated. Clypeus scarcely prominent. Feet slender, rarely hairy. Palpi two. Wings undivided.

FAMILY I. *Phalænida.*

Larva with twelve feet.

455. Phalæna. GENUS CCCCLV. PHALÆNA. Linnæus, Fabricius, Latreille, Leach.

GEOMETRA. Haworth, Hübner.

Antennæ of the male pectinated.

Margaritaria. *Sp.* 1. *Margaritaria,* (large emerald moth), &c.

FAMILY II. *Geometrida.*

Larva with ten feet.

456. Bi- ton. GENUS CCCCLVI. BISTON. Leach.

PHALÆNA. Linnæus, Fabricius, Latreille.

GEOMETRA. Hübner, Haworth.

Antennæ of the male much pectinated. Body thick. Palpi very hairy.

Prodroma ria. *Sp.* 1. *Prodromaria*; 2. *Betularia*; 3. *Hirtaria.*

457. Geo- metr. GENUS CCCCLVII. GEOMETRA. Hübner, Haworth.

PHALÆNA. Fabricius, Latreille, Linnæus.

Antennæ of the male pectinated. Body slender. Palpi but little or not at all hairy. Wings horizontally extended, hinder margin very angular.

Lunaria. *Sp.* 1. *Lunaria*; 2. *Dolabraria,* &c.

458. Ou- rapteryx GENUS CCCCLVIII. OURAPTERYX. Leach.

PHALÆNA. Latreille, Fabricius, Linnæus.

Antennæ somewhat ciliated. Body slender. Palpi but little hairy. Wings horizontally extended, inferior ones prolonged, truncate, and terminated by a tail.

Sambuca ria. *Sp.* 1. *Sambucaria,* (swallow-tail moth).

Inhabits Europe.

459. Abraxa GENUS CCCCLIX. ABRAXAS. Leach.

PHALÆNA. Linnæus, Fabricius, Latreille, Hübner, Haworth.

Antennæ simple, not ciliated. Body slender. Palpi scarcely hirsute. Wings extended horizontally, not angulated or indented.

Grossul ata. *Sp.* 1. *Grossulariata,* (common magpie moth); 2. *Ulmaria,* (scarce magpie moth), &c.

460. Bu- palus. GENUS CCCCLX. BUPALUS. Leach.

PHALÆNA. Linnæus, Fabricius, Latreille.

GEOMETRA. Hübner, Haworth.

Antennæ pectinated in the male. Body slender. Palpi slightly hirsute. Wings horizontally extended, not angulated or indented.

Piniaria *Sp.* 1. *Piniaria.*

Phalæna piniaria. Fabricius, Latreille.

Inhabits pine woods.

461. Hi- parchu GENUS CCCCLXI. HIPPARCHUS. Leach.

PHALÆNA. Fabr. Latr. Linn.

GEOMETRA. Hübner, Haworth.

Wings extended obliquely, the upper covering the lower ones. Body slender. Palpi slightly hirsute. Antennæ of the male pectinated.

Papilio ria. *Sp.* 1. *Papilionaria*; 2. *Prunata,* &c.

FAMILY III. *Herminida.*

Caterpillars with fourteen feet, the anal ones distinct, the first pair of membranaceous ones wanting.

462. H minia. GENUS CCCCLXII. HERMINIA. Latreille.

PHALÆNA (PYRALIS). Linnæus.

CRAMBUS. Fabricius, Bosc.

PYRALIS. Hübner.

Wings triangulate, nearly horizontal, anterior margin of the upper wings straight. Palpi two recurved, compressed, often very large. Antennæ ciliated.

Probo lis. *Sp.* 1. *Proboscidalis,* &c.

FAMILY IV. *Platyptericida.*

Caterpillar with fourteen feet, anal ones wanting, the first pair of membranaceous ones distinct.

463. P typter GENUS CCCCLXIII. PLATYPTERYX. Laspeyres, Latr.

PHALÆNA. Fabricius.

Anterior wings falcate. Antennæ of the male pectinate. Palpi very short, somewhat conic. Tongue short.

Falcat *Sp.* 1. *Falcataria*; 2. *Lacertanaria*; 3. *Cultaria.*

Metabolia. *Obs.* The two last species have their anterior wings dentate.

464. CILIX. GENUS CCCCLXIV. CILIX. Leach.
BOMBYX. Fabricius.
PLATYPTERYX. Latreille.

Anterior wings rounded. Antennæ of the male pectinated. Palpi very short, somewhat conic. Tongue none.

Compressa. *Sp.* 1. *Compressa*, (goose egg moth).
Bombyx compressus. Fabricius.
Platypteryx compressa. Latreille.
Cilix compressa. Leach.

FAMILY V. *Tortricida.*

Caterpillars with sixteen feet. Wings, with the body forming a broad short triangle, dilated on each side anteriorly.

465. TORTRIX. GENUS CCCCLXV. TORTRIX. Hübner.
PHALÆNA (TORTRIX). Linnæus.
PYRALIS. Latreille, Fabricius.

Palpi with the second joint distinctly longer than the third, and more squamous; third joint short, truncate or obtuse, not recurved over the head.

Fagana. *Sp.* 1. *Fagana*; 2. *Chlorana*; 3. *Pomana*, &c.

466. SIMAETHIS. GENUS CCCCLXVI. SIMAETHIS. Leach.
TORTRIX. Hubner.
PYRALIS. Latreille.

Palpi short, rising, the last joint not recurved over the head; with the second and third joints nearly equally long and equally squamose. Inferior wings not completely covered by the upper ones.

Dentana. *Sp.* 1. *Dentana.*
Tortrix dentana. Hübner.
Pyralis dentana. Latreille.
Simäethes dentana. Leach.
Inhabits Europe.

467. NOLA. GENUS CCCCLXVII. NOLA. Leach.
PYRALIS. Hübner, Latreille.

Palpi short, porrect; last joint not recurved over the head; the second and third joints nearly equally long and equally squamose. Under wings completely covered by the upper ones.

Palliolatis. *Sp.* 1. *Palliolatis.*
Pyralis palliolatis. Hübner, Latr.
Nola palliolatis. Leach.
Inhabits Europe.

TRIBE VI. PYRALIDES.

Palpi four. Larva (as far as has been ascertained) with sixteen feet.

FAMILY I. *Pyralida.*

Superior wings forming with the body a nearly horizontal depressed triangle.

468. BOTYS. GENUS CCCCLXVIII. BOTYS. Latr.
PHALÆNA (PYRALIS). Linn.
PYRALIS. Hübner, Schrank, Scopoli.
NYMPHALA. Schrank.
SCOPULA. Schrank.
PYRAUSTA. Schrank.
CRAMBUS. Fabricius.

Tongue distinct, conspicuous. Palpi exserted.

Purpuraria. *Sp.* 1. *Purpuraria.* 2. *Potamogata.* 3. *Verticalis.* 4. *Lemnata*, &c.

469. PYRALIS. GENUS CCCCLXIX. PYRALIS. Hübner, Schrank, Schiffermüller.
PHALÆNA (PYRALIS). Linn.
CRAMBUS. Fabricius.
AGLOSSA. Latreille.

Tongue none. Inferior palpi largest, the second joint very squamous, the squamæ porrected in bundles. Metabolia. Pinguinalis.

Sp. 1. *Pinguinalis.*
Phalæna pyralis pinguinalis. Linn.
Crambus pinguinalis. Fabricius.
Aglossa pinguinalis. Latreille.
Inhabits Europe.

FAMILY II. *Tineida.*

Superior wings very long, enveloping the sides of the body.

GENUS CCCCLXX. GALLERIA. Fabricius, Latr. 470. GALLERIA.
PHALÆNA (TINEA). Linn.

Tongue very short. Palpi short: Inferior palpi largest, with close scales; upper ones concealed by the scales of the clypeus. Wings narrow, covering and pressing against the sides of the body.

Sp. 1. *Alvearia.* Alvearia.
Galeria alvearia. Fabricius, Latr.

GENUS CCCCLXXI. CRAMBUS. Fabr. Latr. 471. CRAMBUS.
PHALÆNA (TINEA). Linn.
TINEA. Geoffroy.

Wings narrow, convoluted round the body. Palpi exserted, inferior ones largest. Head with short closely applied scales. Tongue distinct.

Sp. 1. *Pineti.* 2. *Pascuorum.* 3. *Pratorum*, &c. Pineti.

GENUS CCCCLXXII. TINEA. Hubner, Geoffroy, Scopoli. 472. TINEA.
ALUCITA. Latreille.
PHALÆNA (TINEA). Linn.
YPSOLOPHUS. Fabricius.

Wings narrow abruptly deflexed, behind and above ascending. Inferior palpi with the second joint covered with numerous fasciculi of scales; the last erect, conic, naked. Head with a bifid crest in front.

Sp. 1. *Nemorum.* 2. *Vittatus*, &c. Nemorum.

TRIBE VII. ALUCITIDES.

PTEROPHORITES. Latreille.

Wings divided, or formed of feathers united at their base.

GENUS CCCCLXXIII. PTEROPHORUS. Geoffroy, Latreille, Fabricius. 473. PTEROPHORUS.
ALUCITA. Hübner, Schrank, Scopoli.
PHALÆNA (ALUCITA). Linn.

Palpi small, from their base ascending, not longer than the head, shortly and nearly equally squamose. Anterior wings composed of two, posterior of three feathers. Pupa naked suspended by a hair.

Sp. 1. *Pentadactylus.* 2. *Didactylus*, &c. Pentadactylus.

GENUS CCCCLXXIV. ALUCITA. Hübner, Scopoli. 474. ALUCITA.
PTEROPHORUS. Geoffroy, Fabricius.
PHALÆNA (ALUCITA). Linn. Villers.
ORNEODES. Latreille.

Palpi produced much longer than the head; the second joint very squamous; the last joint naked, erect. Pupa folliculate.

Sp. 1. *Hexadactyla.* Hexadactyla.
Orneodes hexadactylus. Latreille.
Pterophorus hexadactylus. Fabricius.
Phalæna alucita hexadactyla. Linn.
Alucita hexadactyla. Hübner.
Inhabits Europe, often entering houses.

ORDER XII. TRICHOPTERA.

ORDER TRICHOPTERA. Kirby.
ORDER NEUROPTERA. Linn. Cuvier, Latr. Lam.

Characters of the Order.

Wings much deflexed, with strong nervures, hispid or hairy, the lower wings plicate. Antennæ inserted between the eyes, often very long, composed of an infinity of joints. Feet elongate, spinulose. Tarsi elongate, five-jointed; the last joint with two small nails.

Larva elongate, agile, somewhat cylindric, composed of twelve joints, the three first harder than the rest, and each bearing a pair of feet; the last segment with two hooked processes. It inhabits tubes constructed of sand, bits of wood, stone, or grass, glued together by a cement impenetrable to water.

Pupa somewhat resembling the perfect insect, shut up in the tube it lived in whilst a larva, but having the power of motion prior to its emerging from the water (in which it resides), for the purpose of changing into the fly-state.

Genus I. Phryganea. Linn. Fabr. Geoff. Latreille.

Obs. This genus Dr Leach has divided into several genera, from the proportion of the antennæ and palpi. We shall give as many examples as we can; but we must refer to a work which he is about to publish, entitled *Trichoptera Systematica*, for a more particular account, and for the characters of these genera, and of others named, 1. *Ceraclea*, 2. *Göera*, 3. *Potomaria*, 4. *Prosoponia*, 5. *Chimarra*, 6. *Tinodes*, 7. *Philopotamus*, and 8. *Neuronia*.

Tribe I. Leptocerides.

Antennæ much longer than the whole body.

475. Leptocerus. Genus CCCCLXXV. Leptocerus. Leach's MSS.

Antennæ simple, not denticulated.

Interruptus. *Sp.* 1. *Interruptus.*

Phryganea interrupta. Fabricius.

Leptocerus interruptus. Leach's MSS.

Inhabits Great Britain. It is found in great plenty near Luss, on the banks of Loch Lomond, on the margins of rivulets at Dreghorn near Edinburgh, and near Carlisle in northern England. It occurs during the day time on the smaller branches of trees, and in the afternoon flies about in great abundance, in flocks.

476. Odontocerum. Genus CCCCLXXVI. Odontocerum. Leach's MSS.

Antennæ with their inner edge denticulated.

Griseum. *Sp.* 1. *Griseum.*

Odontocerum griseum. Leach's MSS.

Inhabits Ireland and England. It is common at Dunlough Gap, near Killarny; and near Carlisle, on the banks of the Eden river. It has likewise been taken in Norfolk by Mr Scales, near Cheltenham, and near Plymouth, by Dr Leach.

Tribe II. Phryganides.

Antennæ as long as the body.

477. Phryganea. Genus CCCCLXXVII. Phryganea. Leach's MSS.

Anterior wings soft, villose.

Grandis. *Sp.* 1. *Grandis.*

Phryganea grandis. Linn. Fabr. Latr.

Inhabits Europe.

478. Limnephilus. Genus CCCCLXXVIII. Limnephilus. Leach's MSS.

Anterior wings slightly coriaceous, nervures hispid or hairy.

Rhombicus. *Sp.* 1. *Rhombicus.*

Phryganea rhombica. Linn.

Limnephilus rhombicus. Leach's MSS.

Inhabits Europe.

Order XIII. NEUROPTERA.

Order Neuroptera. Linn. Latr. Lam. Cuvier.

Class Odonata. Fabricius.

Class Synistata. Fabricius.

Wings four, naked, reticulated, and divided into a vast number of areolæ.

Sect. I. Subulicornes.

Antennæ subulate, very short, the last joint setiform. Maxillary palpi very short. Wings extended horizontally, or erect, very much reticulated.

Metamorphosis semicomplete.

Larvæ and Pupæ aquatic, somewhat resembling the perfect insect.

Tribe I. Libellulides.

Tarsi three-jointed. Mandibles strong, corneous. Maxillæ corneous, strong. Wings equal, or the hinder ones a little larger at their base. Abdomen not terminated with setæ or filaments. Eyes very large.

Family I. *Libellulida.*

Wings horizontal. Head hemispheric, with a distinct vesicle, on which the little eyes are placed in a triangle, Abdomen more or less depressed. Lip with the middle lamella smallest.

Genus CCCCLXXIX. Libellula. Linn. Fabricius, Latreille, Leach. 479. Li- lula.

Posterior wings alike in both sexes.

Sp. 1. *Depressa.* Depressa.

Libellula depressa. Linn. Fabr. Latr.

Sp. 2. *Conspurcata.* Conspurcata.

Libellula conspurcata. Fabr. Sowerby.

Libellula quadrifusciata. Donovan.

Sp. 3. *Quadrimaculata.* Quadrimaculata.

Libellula quadrimaculata. Linn. Fabr. Donovan.

Sp. 4. *Cancellata.* Cancella

Libellula cancellata. Linn. Donovan.

Inhabits Europe. Is common on the Croydon Canal, near London.

Sp. 5. *Vulgata.* Vulgata.

Libellula vulgata. Linn. Fabr. Donovan.

Sp. 6. *Donovani.* Donovani.

Libellula Donovani. Leach.

Libellula biguttata. Donovan.

Sp. 7. *Scotica.* Scotica.

Libellula Scotica. Leach, Donovan.

Genus CCCCLXXX. Cordulia. Leach's MSS. 480. Co- dulia.

Libellula. Linn. Donovan. Panzer, Latreille.

Posterior wings in the male produced into an angle at the anal edge.

Sp. 1. *Ænea.* Ænea.

Libellula ænea. Linn. Donovan, Panzer, Latreille.

Cordulia ænea. Leach's MSS.

Family II. *Æshnides.*

Wings horizontal. Head hemispheric, without a distinct vesicle for the little eyes, which are arranged in a straight line. Abdomen cylindric, sometimes clavate. Lip with the middle lamella not much smaller than the others.

Genus CCCCLXXXI. Cordulegaster. Leach's MSS. 481. Co- dulegaster.

Libellula. Linn. Donovan.

Æshna. Latreille.

Hinder wings of the male angulated at their anal edge. Abdomen of the male clavate, of the female with an acuminated process.

Annulatus. *Sp.* 1. *Annulatus.*
Libellula forcipata. Harris.
Æshna annulata. Latreille.
Libellula Boltonii. Donovan.
Cordulegaster annulatus. Leach's MSS.
Inhabits Yorkshire, Devonshire, Dorsetshire, Somersetshire, and Cornwall. It likewise occurs amongst the lakes, in the north of England; amongst the Pentland hills, near Edinburgh; and on Loch Lomond and Loch Katrine.

482. Gomphus. GENUS CCCCLXXXII. GOMPHUS. Leach's MSS.
LIBELLULA. Linn. Donovan.
Wings of the male angulated at their anal edge. Abdomen clavate in both sexes.

Vulgatissimus. *Sp.* 1. *Vulgatissimus.*
Libellula vulgatissima. Linn.
Libellula forcipata. Donovan.
Gomphus vulgatissimus. Leach's MSS.
Inhabits Europe. Is occasionally taken near London.

483. Æshna. GENUS CCCCLXXXIII. ÆSHNA. Fabricius.
LIBELLULA. Linn. Donovan.
Hinder wings of the male angulated at their anal edge. Abdomen cylindric in both sexes, not clavate.

Grandis. *Sp.* 1. *Grandis.*
Libellula grandis. Linn. Donovan.
Æshna grandis. Fabricius.
Inhabits Europe.
Obs. There are several European species, which have been confounded with *Æshna grandis.*

84. Anax. GENUS CCCCLXXXIV. ANAX. Leach's MSS.
Hinder wings of the male not angulated at their anal edge, but resembling those of the female. Abdomen cylindric in both sexes; not clavate.

Imperator. *Sp.* 1. *Imperator.*
Inhabits England.

FAMILY III. *Agrionida.*

Wings erect. Head transverse. Abdomen cylindric-linear. Ocelli, or little eyes, placed in a triangle.

85. Agrion. GENUS CCCCLXXXV. AGRION. Fabr. Latreille.
LIBELLULA. Linn.
Wings membranaceous, with a rhomboidal stigma. Abdomen of the male not armed with a forceps-like appendage.
Obs. We have of this genus several indigenous species, not accurately determined.

86. Lestes. GENUS CCCCLXXXVI. LESTES. Leach.
Wings membranaceous, with an oblong quadrate stigma. Abdomen of the male armed with a forceps-like appendage.
Obs. We have three indigenous species.

7. Calepteryx. GENUS CCCCLXXXVII. CALEPTERYX. Leach's MSS.
AGRION. Fabricius Latreille.
Wings coriaceo-membranaceous, without a real stigma, in place of which is sometimes an irregular opaque spot. Abdomen of the male furnished with a forceps-like appendage.
Obs. This genus comprehends those *Agrionida* with coloured wings.

TRIBE II. EPHEMERIDES.

Tarsi four-jointed. Mouth not distinct. Inferior wings much smaller than the others, sometimes wanting. Abdomen with the extremity furnished with filaments.

METAMORPHOSIS quadruple.

FAMILY I. *Bäetida.*

Tail with two filaments.

GENUS CCCCLXXXVIII. BAETIS. Leach's MSS. 488. Baetis.
EPHEMERA. Linn. Fabricius, Latreille.
Wings four.
Sp. 1. *Bioculatus.* Bioculatis.
Ephemera bioculata. Linn. Fabr.
Bäetis bioculatus. Leach's MSS.
Inhabits Europe.

GENUS CCCCLXXXIX. CLOEON. Leach. 489. Cloeon.
EPHEMERA. Linn. Fabricius.
Wings two.
Sp. 1. *Pallida.* Pallida.
Ephemera diptera. Linn. Fabr.
Clöeon pallida. Leach's MSS.

FAMILY II. *Ephemerida.*

Tail with three filaments.

GENUS CCCCXC. EPHEMERA. Linn. Fabr. Latr. Leach. 490. Ephemera.
Sp. 1. *Vulgata.* Vulgata.
Ephemera vulgata. Linn. Fabr.
Inhabits Europe.

SECT. II. FILICORNES.

Antennæ longer than the head, not subulate. Wings generally deflexed, or incumbent.

TRIBE I. PANORPIDES.

Head anteriorly produced into a rostrum.

FAMILY I. *Physapida.*

Wings extended, unequal, anterior ones somewhat triangulate-rounded, the hinder ones very long, linear. Ocelli none.

GENUS CCCCXCI. PHYSAPUS. 491. Physapus.
PANORPA. Linn. Fabricius.
NEMOPTERA. Latreille.
Sp. 1. *Coa.* Coa.
Panorpa coa. Linn. Fabr.
Nemoptera coa. Latreille.
Inhabits Portugal, Spain, and the islands of the Archipelago.

FAMILY II. *Panorpida.*

Wings equal, ovate-elliptic, laying one over the other. Ocelli three, approximate, arranged in a triangle.

GENUS CCCCXCII. PANORPA. Linn. Fabr. Lam. Latr. 492. Panorpa.
Tarsi with two bent claws, denticulated beneath, having a spongy pulvillus between them. Palpi nearly equal, filiform; the last joint cylindric-ovate. Mandibles with their points distinctly bidentate. Abdomen of the male with the three last joints forming a tail armed with a forceps.
Sp. 1. *Communis.* Communis.
Panorpa communis. Linn. Fabr. Latr. Panz.
Inhabits Europe.

GENUS CCCCXCIII. BITTACUS. Latreille. 493. Bittacus.
PANORPA. Linn. Fabr.
Tarsi with a single nail. Palpi of the maxillæ distinctly longer than the labial ones; the second and third joint much lengthened, thicker: labial palpi with two elongate cylindric joints. Mandibles very long, narrow; apex acute, entire. Abdomen cylindric, that of the male not terminated with a forceps. Legs long.
Sp. 1. *Tipularius.* Obscure reddish; wings imma- Tipularius.

Metabolia. culate; external margins ciliated; stigmata obscure; points of the tibiæ fuscous.

Panorpa tipularia. Linn. Fabr.
Bittacus tipularius. Latreille.
Inhabits southern France.

TRIBE II. MYRMELEONIDES.*

Antennæ thicker towards their extremities. Palpi six. Wings equal. Tarsi five-jointed, the first and last joints longest; claws two, strong, elongate, acute.

494. Myrmeleon. GENUS CCCCXCIV. MYRMELEON. Linnæus, De Geer, Fabricius, Latreille, Leach.

Antennæ gradually thicker towards their extremities; shorter than the body. Eyes entire. Abdomen very long, linear. Labial palpi very long, apex obconic, truncate.

Libelluloides. *Sp*. 1. *Libelluloides*. Body yellow, lineated with black; antennæ black; wings hyaline, with distant spots and points of blackish colour; under wings less maculated, with two abbreviated blackish bands; feet variegated.

Myrmeleon libelluloides. Linn. Latr. Fabr.
Inhabits the south of Europe, and all Africa.

495. Formicaleo. GENUS CCCCXCV. FORMICALEO. Geoff. Leach.
MYRMELEON. Linn. Fabricius, Latreille.

Antennæ gradually thicker towards their extremities; shorter than the body. Eyes entire. Abdomen very long, linear. Labial palpi with the last joint incrassate fusiform, subulated towards the apex.

Formicarius. *Sp*. 1. *Formicarius*. Wings hyaline, apex acute maculated with fuscous; costal mark and some anastomoses whitish.

Myrmeleon formicarium. Linn. Latr. Fabr.
Formicaleo formicarius. Leach's MSS.
Inhabits Europe in sandy districts; it varies with immaculate wings.

496. Ascalaphus. GENUS CCCCXCVI. ASCALAPHUS. Fabricius, Latreille, Lamarck, Leach.
LIBELLOIDES. Schæffer.
MYRMELEON. Linn.

Antennæ abruptly terminated by an obtrigonate club. Eyes composed of two conjoined segments. Abdomen longer than the thorax, long-ovate.

Barbarus. *Sp*. 1. *Barbarus*. Body black spotted with yellow; wings nervured with golden yellow; upper ones from the base of the hinder margin even to the border, blackish, the border broadly paler; inferior ones with the base blackish, hyaline in the middle, the apex black.

Ascalaphus barbarus. Fabricius, Latreille.
Inhabits Barbary.

Italicus. *Sp*. 2. *Italicus*. Black, maculated with luteous; wings obscurely nervured; superior ones with their basial costa, and with a spot opposite to the internal margin, white, yellow, or sulphur coloured, the intermediate space black: under ones with the base black, the middle white-yellow, the posterior margin and apex blackish.

Ascalaphus italicus. Fabricius, Latreille.
Inhabits southern Europe and part of Germany.

TRIBE III. HEMEROBIDES.

Antennæ filiform or setaceous. Palpi four. Wings equal. Tarsi five-jointed.

FAMILY I. *Hemerobida*.

Ocelli, or little eyes, not distinct.

497. Chrysopa. GENUS CCCCXCVII. CHRYSOPA. Leach's MSS.
HEMEROBIUS. Linné, Geoffroy, Fabricius, Latreille, Olivier, Lamarck.

Antennæ (at least as long as the body) with cylindric joints longer than broad.

Perla. *Sp*. 1. *Perla*.
Hemerobius perla. Linné, Fabricius, Latreille.
Chrysopa perla. Leach's MSS.
Inhabits woods.

Reticulata. *Sp*. 2. *Reticulata*.
Hemerobius chrysops. Linn.
Chrysopa reticulata. Leach's MSS.
Inhabits Europe.

498. Hemerobius. GENUS CCCCXCVIII. HEMEROBIUS.† Linné, Fabricius, Latreille, Lamarck, Leach.

Antennæ as long, or shorter than the body, joints moniliform.

Hirtus. *Sp*. 1. *Hirtus*.
Hemerobius hirtus. Linn. Fabr. Latr.
Inhabits Germany.

FAMILY II. *Osmylida*.‡

Ocelli three distinct.

499. Osmylus. GENUS CCCCXCIX. OSMYLUS. Latreille.
HEMEROBIUS. Fabr. Villers, Rœmer, Donovan.

Antennæ moniliform,

Maculatus. *Sp*. 1. *Maculatus*. Fuscous; head and feet testaceous; wings hairy, the upper ones and the costal margin of the inferior ones spotted with black.

Hemerobius maculatus. Fabricius,
Hemerobius chrysops. Rœmer, Donovan.
Hemerobius fulvicephalus. Villers.
Inhabits France, Germany, and England; confounded with *Hemerobius chrysops* of Linnæus.

TRIBE IV. CORYDALIDES.

Thorax with the first segment large, not much longer than broad. Tarsi five-jointed. Wings of equal size. Feet resembling each other.

FAMILY I. *Corydalida*.

Ocelli three arranged in a triangle. Wings incumbent horizontally. Tarsi with all the joints entire.

500. Corydalis. GENUS D. CORYDALIS. Latreille, Palisot.
HEMEROBIUS. Fabricius, Olivier.
RAPHIDIA. Linn.

Antennæ simple, the joints very short, cylindric. Mandibles very large as long as the thorax. Head broader than the thorax.

Obs. Latreille considers this genus akin to *Raphidia*, notwithstanding the difference of the tarsal joints, both in number and form.

Cornuta. *Sp*. 1. *Cornuta*.
Hemerobius cornutus. Fabricius, Olivier.
Corydalis cornutus. Latreille, Palisot de Beauvois.
Raphidia cornuta. Linn.
Inhabits Africa, and part of America.

501. Chauliodes. GENUS DI. CHAULIODES. Latreille, Palisot.
HEMEROBIUS. Linn. De Geer, Olivier.
SEMBLIS. Fabricius.

Antennæ pectinated. Mandibles short. Head of the same breadth as the thorax.

Pectinicornis. *Sp*. 1. *Pectinicornis*.
Hemerobius pectinicornis. Linn.
Semblis pectinicornis. Fabricius.
Chauliodes pectinicornis. Latr. Palisot de Beauvois.

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* This tribe probably contains two families.

† *Hemerobius phalænioides* Dr Leach places in a peculiar genus named DREPANEPTERYX.

‡ In the first volume of the *Zoological Miscellany*, is instituted a new genus, named NYMPHES, which belongs to this family.

Inhabits northern America.

FAMILY II. *Sialidæ.*

Wings deflexed. Tarsi with the last joint but one bifid. Ocelli none.

502. Sialis. GENUS DII. SIALIS. Latreille.
HEMEROBIUS. Geoffroy, De Geer, Olivier.
SEMBLIS. Fabricius.

Niger. *Sp.* 1. *Niger.*
Hémérobe aquatic noir. De Geer.
Hemerobius lutrarius. Linnæus?
Semblis lutrarius? Fabricius.
Inhabits Europe. The larva in water.

TRIBE V. MANTISPIDES.

Anterior feet raptorious. Thorax with the first segment large, long. Tarsi five-jointed. Wings of equal size, deflexed.

503. Mantispa. GENUS DIII. MANTISPA. Illiger, Latreille.
RAPHIDIA. Scopoli, Linnæus.
MANTIS. Fabricius, Pallas, Olivier.
Nerveures hairy.

Pagana. *Sp.* 1. *Pagana.* Pubescent-yellowish; thorax roughish; elytra with a yellowish costa, stigma darker.
Mantispa pagana. Illiger, Latreille.
Raphidia mantispa. Scopoli, Linn.
Mantis persa. Pallas.
Mantis pagana. Fabricius, Panzer.
Inhabits France and Germany.

TRIBE VI. RAPHIDIDES.

Wings of equal size. Thorax with the first segment large. Tarsi with four distinct joints, the last but one bilobate. Antennæ nearly setaceous. Ocelli three, arranged in a triangle.

504. Raphidia. GENUS DIV. RAPHIDIA. Linn. Geoff. De Geer, Fabr. Oliv. Lam. Latr.

Head oval, narrowed behind, inflexed. Thorax with the first segment very long, narrow, and somewhat cylindric. Anus of the females with two united setæ.

Ophiopsis. *Sp.* 1. *Ophiopsis.*
Raphidia ophiopsis. Linn. Fabr. Latr.
Inhabits Europe.

TRIBE VII. TERMITIDES.

Wings of equal size, horizontally incumbent. Thorax with the first segment large. Tarsi with three distinct joints, the penultimate joint entire. Antennæ moniliform, inserted before the eyes. Head short, rounded behind. Ocellus one.

The animals of this tribe congregate in great numbers, and live in societies, being generally known by the term white ants, a name applied to all the species indiscriminately.

505. Termes. GENUS DV. TERMES. Linn. De Geer, Fabr. Oliv. Lam. Latr.
PERLA. De Geer.
HEMEROBIUS. Linn.

Lucifugum. *Sp.* 1. *Lucifugum.* Black, shining, and pubescent; thorax transversely quadrate, with the angles rounded, with an impression on each side of the anterior part, the intermediate space somewhat carinated; wings fuscescent-hyaline, the costa blackish; apex of the joints of the antennæ, tibiæ, (base excepted), and all the tarsi, pale-reddish.
Termes lucifugum. Rossi, Latreille.
Inhabits Italy.

TRIBE VIII. PSOCIDES.

Inferior wings smaller than the superior ones. Some are apterous. Palpi two, composed of four joints.

FAMILY I. *Psocidæ.*

Tarsi two-jointed.

GENUS DVI. PSOCUS. Latr. Fabr. Lam. Coquebert. 506. Psocus.
HEMEROBIUS. Linnæus.
Wings four.

Sp. 1. *Bipunctatus.* Variegated with yellow and black; head above the clypeus blackish; superior wings with a small costal mark, and another on the opposite margin black; the interjected cords blackish; stigma white, with a black spot. Bipunctatus.
Psocus bipunctatus. Latreille, Fabricius, Coquebert.
Hemerobius bipunctatus. Linn.
Inhabits Europe.

FAMILY II. *Atropidæ.*

Tarsi three-jointed.

GENUS DVII. ATROPOS. Leach's MSS. 507. Atropos.
TERMES. Linn. De Geer.
PSOCUS. Fabricius, Latreille, Coquebert.
PEDICULUS. (POU,) Geoffroy.

Sp. 1. *Lignaria.* Lignaria.
Termes pulsatorium. Linn.
Termes lignarium. De Geer.
Le Pou du Bois. Geoffroy.
Psocus pulsatorius. Fabricius, Latreille, Coquebert.
Inhabits old books, often beating like a watch, whence it has acquired the name of death-watch.

Psocus fatedicus of Fabricius, is referable to the genus Atropos, but whether it be a distinct species from *Atropos lignaria* is certainly very doubtful.

TRIBE IX. PERLARIDES.

Inferior wings larger than the superior ones, with longitudinal folds. Tarsi with three joints. Mandibles distinct. Thorax with the first segment large.

Obs. The wings horizontally incumbent.

GENUS DVIII. NEMOURA. Latreille. 508. Nemoura.
PHRYGANEA. Linnæus.
PERLA. Geoffroy, De Geer.
SEMBLIS. Fabricius.

Labrum very distinct, almost semicircular. Mandibles corneous. Palpi filiform. Tarsi with equal lengthened joints (the middle one scarcely shorter) not spongy beneath. Anus without setæ.

Sp. 1. *Nebulosa.* Fuscous-black, pubescent; abdomen and feet reddish-fuscous; wings cinereous, immaculate, the nerveures darker. Nebulosa.
Le Perle Brune à ailes pâles. Geoffroy.
Nemoura nebulosa. Latreille.
Inhabits Europe.

GENUS DIX. PERLA. Geoffroy, De Geer, Olivier, Lamarck, Latreille. 509. Perla.
PHRYGANEA. Linn.
SEMBLIS. Fabricius.

Labrum obscure, transversely linear. Mandibles almost membranaceous. Palpi almost setaceous. Tarsi with the two basal joints shorter than the third. Anus with two long setæ.

Sp. 1. *Marginata.* Marginata.
Semblis marginata. Fabricius.
Perla marginata. Latreille.
Inhabits Europe.

Phryganea bicaudata of Linnæus belongs to this genus.

Metabolia.

ORDER XIV. HYMENOPTERA.

ORDER HYMENOPTERA. Linn. Latr. Lam. Cuvier.
CLASS PIEZATA. Fabricius.

Characters of the Order.

Wings nervured, (the aveolæ large and unequal in size,) the inferior ones smaller than the upper. Anus of the females with a sting or an oviduct.

SECTION I. TEREBRANTIA.

Oviduct lamelliform or filiform, in a few resembling a sting and valved; the vagina bivalve, received in a canal beneath before the anus, the valves compressed, in some compressed lamelliform; in others elongate-cylindric, setaceous.

DIVISION I.

Abdomen united to the thorax along its whole breadth, without any distinct peduncle.

TRIBE I. TENTHREDINIDES.

Abdomen sessile. Oviduct composed of two lamellæ which are serrated. Mandibles more or less long, terminated by two strong teeth. Wings with the marginal cells complete.

FAMILY I. *Tenthridinida.*

Labrum distinct. Larvæ with membranaceous feet.

510. CIMBEX. GENUS DX. CIMBEX. Oliv. Fabr. Spinoli, Latr.
TENTHREDO. Linnæus, Jurine, Panzer, De Geer.
CRABRO. Geoffroy.
CLAVELLARIA. De Lamarck.

Antennæ terminated by a distinct club, nearly ovoid.

Obs. This genus is artificial; it contains several natural genera, which may be defined from the joints composing their antennæ.

* Antennæ with five joints before the club, which is nearly solid.

Femorata. *Sp.* 1. *Femorata.* Fabricius.
Axillaris. *Sp.* 2. *Axillaris.* Panzer.

** Antennæ with five joints before the club, which is distinctly articulated.

Leucorum. *Sp.* 3. *Leucorum.* Fabricius.

*** Antennæ with four joints before the club, which is indistinctly articulated.

Amerinæ. *Sp.* 4. *Amerinæ.* Fabricius, Panzer.
Marginata. *Sp.* 5. *Marginata.* Fabricius, Panzer.
Læta. *Sp.* 6. *Læta.* Panzer.
Obscura. *Sp.* 7. *Obscura.* Panzer.

**** Antennæ with four joints before the club, which is two-jointed.

Faciata. *Sp.* 8. *Faciata.* Fabricius, Panzer.

***** Antennæ with four joints before the club, which is composed of three joints.

Sericea. *Sp.* 9. *Sericea.* Fabricius, Panzer.

Tenthredo sericea and *nitens* of Linnæus are but sexual distinctions of the same species.

511. HYLOTOMA. GENUS DXI. HYLOTOMA. Latr. Fabr. Spinoli.
TENTHREDO. Linné, Geoffroy, De Geer, Panzer, Lamarck, Olivier.
CRYPTUS. Jurine.
ARGE. Schrank.

Antennæ gradually thickening towards their extremities, composed of three joints. Superior wings with four submarginal cells, and one marginal cell emitting a little branch.

Metabolia.

Rosæ. *Sp.* 1. *Rosæ.*
Tenthredo rosæ. Linn.
Hylotoma rosæ. Fabricius, Latreille.
Inhabits Europe.

Obs. Hylotoma furcata of Latreille, *Tenthredo furcata* of Panzer, and its congeners, are distinguished from the genuine *Hylotomæ*, by having filiform bifurcate antennæ, and should constitute a peculiar genus.

512. TENTHREDO. GENUS DXII. TENTHREDO.* Linné, Geoffroy, De Geer, Latreille.
ALLANTUS. Jurine.

Antennæ simple, composed of nine joints. Superior wings with two marginal and with four submarginal cells.

Scrophulariæ. *Sp.* 1. *Scrophulariæ.*
Tenthredo scrophulariæ. Linn. Fabr. Panzer.
Allantus scrophulariæ. Jurine.
Inhabits *Scrophularia nodosa* and *aquatica* when in flower.

Militaris. *Sp.* 2. *Militaris.*
Tenthredo militaris. Fabricius, Panzer.
Inhabits grassy places and the margins of woods.

513. DOLERUS. GENUS DXIII. DOLERUS. Jurine, Latreille.
TENTHREDO. Fabricius, Linnæus.

Antennæ simple, nine-jointed. Superior wings with two marginal and three submarginal cells.

Gonagra. *Sp.* 1. *Gonagra.*
Dolerus gonager. Jurine, Latreille.
Tenthredo gonagra. Fabricius, Panzer.
Inhabits Europe.

514. NEMATUS. GENUS DXIV. NEMATUS. Jurine, Latreille.

Antennæ simple, nine-jointed. Superior wings with one marginal and four submarginal cells.

Septentrionalis. *Sp.* 1. *Septentrionalis.*
Tenthredo septentrionalis. Fabr. Panzer.
Nematus septentrionalis. Jurine, Latr.
Inhabits the European woods.

515. PRISTIPHORA. GENUS DXV. PRISTIPHORA. Latr.
PTERONIS. Jurine.

Antennæ simple, nine-jointed. Superior wings with one marginal, and three submarginal cells. Mandibles bidentate.

Testacea. *Sp.* 1. *Testacea.*
Pteronus testaceus. Jurine.
Pristiphora testacea. Latr.

516. CLADIUS. GENUS DXVI. CLADIUS. Latr. Illiger.
TENTHREDO. Panzer.

Antennæ nine-jointed, branched in the male, simple in the female. Superior wings with one marginal and four submarginal areolæ or cells. Mandibles bidentate.

Difformis. *Sp.* 1. *Difformis.*
Tenthredo difformis. Panzer.
Cladius difformis. Latr.
Inhabits Europe.

517. LOPHYRUS. GENUS DXVII. LOPHYRUS. Latr.
PTERONUS. Jurine.
HYLOTOMA. Fabr.
TENTHREDO. Linn. De Geer, Oliv. Lam. Panzer.

Antennæ pennated in the males, serrated in the females. Superior wings with one marginal and three submarginal cells. Mandibles tridentate.

Pini. *Sp.* 1. *Pini.*
Tenthredo pini. Linn.

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* Some species which are placed in this genus by Latreille, have ten or fourteen joints in their antennæ; these should constitute distinct genera.

Hyloloma pini. Fabr.

Lophyrus pini. Latr.

Inhabits Europe.

Family II. *Xiphydrida.*

Labrum obscure. Larvæ with scaly feet, or at least not membranaceous.

518. Megaladontes. Genus DXVIII. Megaladontes. Latr. Spinoli.

Tarpa. Fabr. Panzer.

Cephaleia. Jurine.

Diprion. Schrank.

Mandibles long, slender, and strongly bent. Neck not elongate. Oviduct not exserted. Antennæ pectinated or serrated.

Cephalotes. *Sp.* 1. *Cephalotes.*

Megalodontes cephalotes. Spinoli, Latr.

Tarpa cephalotes. Fabr.

Inhabits Europe.

519. Pamphilius. Genus DXIX. Pamphilius. Latr. Olivier.

Tenthredo. Linn. Lamarck, Panzer.

Lyda. Fabr. Spinoli.

Cephaleia. Jurine.

Psen. Schrank.

Mandibles long, slender, and strongly bent. Neck not elongate. Oviduct not exserted. Antennæ simple in both sexes.

Erythrocephalus. *Sp.* 1. *Erythrocephalus.*

Pamphilus erythrocephalus. Latr.

Lyda erythrocephala. Fabr.

Inhabits Germany and England.

520. Cephus. Genus DXX. Cephus. Latr. Fabr. Panz.

Sirex. Linn.

Astatus. Klug.

Trachelus. Jurine.

Mandibles exserted, longer than wide. Neck long. Oviduct exserted. Antennæ inserted in the front between the eyes, gradually thicker externally.

Troglodyta. *Sp.* 1. *Troglodyta.*

Cephus troglodyta. Panzer, Latr.

Inhabits Europe.

Pygmæus. *Sp.* 2. *Pygmæus.*

Cephus pygmæus. Latr. Fabr.

Sirex pygmæus. Linn.

Inhabits Europe.

521. Xiphydria. Genus DXXI. Xiphydria. Latr. Fabr. Panz. Spinoli.

Sirex. Linn.

Urocerus. Jurine.

Hybonotus. Klug.

Mandibles exserted, longer than wide. Neck long. Oviduct exserted. Antennæ setaceous, inserted above the clypeus.

Camelus. *Sp.* 1. *Camelus.*

Sirex camelus. Linn.

Hybonotus camelus. Klug.

Xiphydria camelus. Latr. Fabr.

Inhabits Europe.

Dromedarius. *Sp.* 2. *Dromedarius.*

Hybonotus dromedarius. Klug.

Xiphydria dromedarius. Latr. Fabr.

Inhabits Europe.

Tribe II. Uroceridæ.*

Abdomen sessile. Oviduct filiform, exserted, or inclosed in a groove beneath the abdomen. Mandibles short.

522. Oryssus. Genus DXXII. Oryssus. Latr. Fabr. Jurine, Lam. Klug. Panz.

Sphex. Scopoli.

Mandibles with their internal edge not dentated. Maxillary palpi long and pendulous. Antennæ filiform, compressed, inserted under the anterior margin of the clypeus. Superior wings with one marginal cell, and two submarginal, the last incomplete. Oviduct capillary, hidden in a longitudinal groove.

Coronatus. *Sp.* 1. *Coronatus.*

Oryssus coronatus. Fabr. Latr. Coquebert.

Oryssus vespertilio. Klug, Panzer.

Sphex abietina. Scopoli.

Inhabits Europe.

523. Urocerus. Genus DXXIII. Urocerus. Geoff. Schæff. Oliv. Lam. Latr. Leach.

Sirex. Linn. Fabr. Jurine, Panz. Klug, Leach.

Ichneumon. De Geer, Scopoli.

Mandibles dentated on their internal edge. Maxillary palpi very small. Labial palpi terminated by a very thick, hairy joint. Antennæ gradually narrowing externally, inserted in the front; longer than the thorax. Superior wings with two marginal and two submarginal cells complete. Abdomen terminating in a point. Oviduct exserted, composed of three parts, the outer ones valviform.

Obs. This genus contains two great divisions, which, from their characters, are evidently natural genera.

* Antennæ with 25 joints. Abdomen of the female terminated with an abrupt elongate horn. Labial palpi with a distinct basal joint. Maxillary palpi with two distinct joints of equal length.

Urocerus. Genus Urocerus. Leach.

Gigas. *Sp.* 1. *Gigas.*

Sirex mariscus. Fabr. (Male).

Sirex gigas. Linn. Fabr. Latr. (Female).

Urocerus gigas. Latr.

Inhabits Europe. Is rare in Britain.

Psyllius. *Sp.* 2. *Psyllius.*

Sirex psyllius. Fabr. Klug.

Urocerus gigas. (Variety). Latr.

Inhabits Europe. Was taken near Edinburgh by Mr John Wilson, of the College, Edinburgh.

** Antennæ with 21 or 23 joints. Maxillary palpi with their basal joint very short, scarcely to be found.

A. Abdomen of the female terminated by an abrupt, elongate horn. Labial palpi distinctly triaticulated.

Sirex. Genus Sirex. Leach.

Spectrum. *Sp.* 3. *Spectrum.*

Sirex emarginatus. Fabr. (Male).

Sirex spectrum. Linn. Panzer, Klug. (Female).

Urocerus spectrum. Latr.

B. Abdomen of the female with the extremity gradually acuminated.

Juvencus. *Sp.* 4. *Juvencus.*

Sirex juvencus. Linn. Fabr. Klug, (Female).

Sirex noctilio. Fabr. Panzer, (Male).

Urocerus juvencus. Latr.

Sirex juvencus. Leach.

Inhabits Europe. Is rare in Britain.

524. Tremex. Genus DXXIV. Tremex. Latr.

Sirex. Jurine, Fabr. Klug.

Mandibles denticulated on their internal edge. Maxillary palpi very small. Labial palpi terminated by a joint, very thick and very hairy. Antennæ setaceous,

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* This tribe, Dr Leach has proposed to divide into two families, the one to contain the genus *Oryssus*, the other *Sirex*, *Urocerus* and *Tremex*.

Metabolia. inserted in the front. Superior wings with two marginal, and two submarginal cells, complete. Abdomen terminating in a point. Oviduct exserted, composed of three parts, the outer ones valviform.

Fuscicornis. *Sp.* 1. *Fuscicornis.*
Sirex fuscicornis. Fabr. Klug.
Tremex fuscicornis. Latr.

Columba. *Sp.* 2. *Columba.*
Sirex columba. Fabr.
Tremex columba. Latr.

Division II.

Abdomen united to the thorax by a slender peduncle.

Tribe III. Evanides.

Inferior wings with very distinct nervures. Antennæ with 13 or 14 joints.

525. Evania. Genus DXXV. Evania. Fabr. Oliv. Lam. Jurine, Panzer.
Sphex. Linn.
Ichneumon. De Geer.

Abdomen very small, much compressed, triangular or ovoid, abruptly pediculated, and inserted behind the metathorax.

* Antennæ with the third joint much longer than the second. Upper wings with distinct nervures and cells. Mandibles with their internal edge truncate-unidentate. Maxillary palpi with five distinct joints, the basal joint obsolete; the last joint but one of the labial palpi much dilated. Superior wings with a triangular marginal cell; first submarginal cell distinct; the second open; three middle cells open beneath.

Lævigata. *Sp.* 1. *Lævigata.*
Evanie lisse. Oliv.
Evania appendigaster. Fabr.
Evania lævigata. Latr.
Inhabits America.

Dr Leach has seen this insect alive in some boxes of American insects, and he possesses two specimens taken at large in London.

** Antennæ with the third joint much longer than the second. Upper wings with distinct nervures and cells. Mandibles with their internal edge distinctly and acutely tridentate. Maxillary palpi with six distinct joints; the last joint but one of the labial palpi not much dilated. Superior wings with the marginal cell semiovate; middle cells two; apex without cells.

Appendigaster. *Sp.* 2. *Appendigaster.*
Evania appendigaster. Panz. Oliv. Latr.
Sphex appendigaster. Linn.
Inhabits southern France, Spain, and Italy.

*** Antennæ with the third joint not much longer than the second. Superior wings with the nervures and cells obliterated.

Minuta. *Sp.* 3. *Minuta.*
Evania minuta. Oliv. Fabr. Latr.
Brachygaster minutus. Leach's MSS.
Inhabits France and England.

526. Fœnus. Genus DXXVI. Fœnus. Fabr. Latr. Jurine, Panz.
Ichneumon. Linn. Geoff. De Geer.
Gasteruption. Latr. (obsolete).

Neck elongate. Hinder tibiæ clavate. Abdomen a lengthened club.

Jaculator. *Sp.* 1. *Jaculator.*
Fœnus jaculator. Fabr. Panz. Latr.
Ichneumon jaculator. Linn.
Inhabits Europe.

527. Pelecinus. Genus DXXVII. Pelecinus. Latr. Fabr.

Neck not apparent. Hinder tibiæ clavate. Abdomen slender, long, and filiform.

Polycerator. *Sp.* 1. *Polycerator.*
Pelecinus polycerator. Latr. Fabr.
Inhabits America.

528. Aulacus. Genus DXXVIII. Aulacus. Jurine, Spinoli.

Abdomen elliptic, compressed, with a gradually formed peduncle, inserted at the extremity of an elevation in the metathorax.

Striatus. *Sp.* 1. *Striatus.*
Aulacus striatus. Jurine, Latr.
Inhabits the Alps.

Tribe IV. Ichneumonides.

Abdomen attached to the thorax by a part of its transverse diameter. Inferior wings with very distinct nervures. Antennæ with 21 joints and more.

Family I. *Stephanida.*

Mandibles terminated by an entire point, or with but a very obscure notch. Head globose.

529. Ste phanus. Genus DXXIX. Stephanus. Jurine, Illiger, Latreille.
Bracon. Fabr. Panzer.

Thorax much attenuated anteriorly. Metathorax cylindric, straight or horizontal. Abdomen inserted at the superior and posterior extremity of the metathorax, the first segment abruptly narrower than the rest.

Coron *Sp.* 1. *Coronatus.*
Stephanus coronatus. Jurine, Latr.
Bracon serrator. Fabr. Panzer.
Inhabits Germany.

530. Xo des. Genus DXXX. Xorides. Latr.
Anomalon. Jurine.
Cryptus. Fabr.

Metathorax with the hinder segment convex, and at the apex rounded. Abdomen distinctly pedunculated, inserted under the posterior and superior apex of the metathorax.

Indica rius. *Sp.* 1. *Indicatorius.*
Xorides indicatorius. Latr.
Inhabits Europe.

Family II. *Ichneumonida.*

Mandibles bidentate, or notched at their extremity.

Division I.

Abdomen with five very distinct segments.

Subdivision 1.

Superior wings with the first submarginal cell very large; the two discoidal cells situated longitudinally, one above the other.

531. I neu Genus DXXXI. Ichneumon. Latreille.

Maxillary palpi with very unequal joints. Oviduct with its base not covered by a large scale, exserted.

Obs. This genus, which has been attentively examined by Latreille, consists of several natural genera; but the characters are obscure, and are not yet fully understood. Under this head, the following genera, (or parts of them), proposed by Jurine, Fabricius, Panzer, Illiger, and Walckenaer, are comprehended; viz. 1. *Cryptus*, 2. *Bassus*, 3. *Pimpla*, 4. *Joppa*, 5. *Metopius*, 6. *Tragus*, 7. *Alomya*, 8. *Peltastes*, 9. *Ophion*, and, 10. *Banchus*.

Metabolia. The following divisions are proposed by Latreille, who has submitted these insects to a scrupulous and daily investigation.

Division A.

Abdomen but little or not at all compressed.

Subdivision a.

Extremity of the abdomen of the female compressed, and obliquely truncated; oviduct exserted.

1. * Abdomen cylindric, with a very short peduncle.
   GENUS PIMPLA of Fabricius.
2. ** Abdomen somewhat ovoid, with the peduncle long, slender, and arcuate.
   GENUS CRYPTUS of Fabricius.

Subdivision b.

Extremity of the abdomen of the female slightly compressed, not obliquely truncated; oviduct scarcely prominent or exserted.

3. * Abdomen cylindric, almost sessile.
   GENUS METOPIUS of Panzer; PELASTES of Illiger.
4. ** Abdomen almost fusiform or cylindric, gradually narrower towards the base; the peduncle not slender or arcuate.
   GENUS ALOMYA of Panzer.
5. *** Abdomen ellipsoid or ovalate, with the peduncle slender and arcuate.
   GENUS ICHNEUMON of Fabricius.

Division B.

Abdomen very much compressed.

6. * Abdomen, apex truncate in the females.
   GENUS OPHION of Fabricius.
7. ** Abdomen with the apex pointed.
   GENUS BANCHUS of Fabricius.

2. Acæ-itus. GENUS DXXXII. ACÆNITUS. Latr.
CRYPTUS. Fabr. Panzer.
ICHNEUMON. Schæffer, Scopoli, Oliv.
ANOMALON. Jurine.

Palpi with their joints not very unlike each other. Oviduct covered at its base by a large scale.

bitator. *Sp.* 1. *Dubitator.*
Cryptus dubitator. Fabr. Panzer.
Acænitus dubitator. Latr.
Inhabits Germany.

Subdivision 2.

Superior wings with the first submarginal cell small, or moderately sized; the two discoidal cells placed in a transverse line by the side of each other.

Bra-s. GENUS DXXXIII. BRACON. Jurine, Fabr. Panzer, Illiger, Spinoli, Latr.
ICHNEUMON. Linn. Scopoli, Schrank.
VIPIO. Latr. (Rejected name).

Mouth produced into a rostrum. Superior wings with the two first submarginal cells nearly equal, square.

sertor. *Sp.* 1 *Desertor.*
Bracon desertor. Fabr. Latr.

Aga-a. GENUS DXXXIV. AGATHIS. Latr.
ICHNEUMON. Jurine.
BRACON. Fabr. Spinoli.

Mouth produced into a rostrum. Superior wings with the second submarginal cell very small.

zeri. *Sp.* 1. *Panzeri.*
Ichneumon panzeri. Jurine.
Agathis panzeri. Latreille.

Metabolia. 535. Microgaster. GENUS DXXXV. MICROGASTER. Latreille, Illiger, Spinoli.
ICHNEUMON. Linnæus, Fabricius, Jurine, Rossi.
CEROPALES. Fabricius.
CRYPTUS. Fabricius.
BASSUS. Panzer.

Mouth not produced. Abdomen very small and depressed. Oviduct short. Superior wings with one marginal cell nearly obsolete in some, and three submarginal; the second minute, the last terminal imperfect.

Deprimator. *Sp.* 1. *Deprimator.*
Ichneumon deprimator. Fabricius.
Microgaster deprimator. Latreille.
Inhabits Germany.

DIVISION II.

Abdomen almost inarticulate, with but three distinct segments.

536. Sigalphus. GENUS DXXXVI. SIGALPHUS. Latreille, Spinoli.
SPHÆROPYX. Hoffmansegg.
CRYPTUS. Fabricius.
ICHNEUMON. Fabricius.
CHELONUS. Jurine, Panz. Illiger.
BRACON. Jurine.

Irrorator. *Sp.* 1. *Irrorator.*
Sigalphus irrorator. Latreille.
Cryptus irrorator. Fabricius.

FAMILY III. *Alysiada.*

Mandibles tridentate at their extremities, forming an irregular square.

537. Alysia. GENUS DXXXVII. ALYSIA. Latr.
CRYPTUS. Fabricius.
BASSUS. Panzer.
BRACON. Jurine.
CECHENUS. Illiger.

Manducator. *Sp.* 1. *Manducator.*
Cryptus manducator. Fabricius.
Bracon manducator. Jurine.
Bassus manducator. Panzer.
Inhabits Germany.

TRIBE X. DIPLOLEPIDES.

Abdomen inserted to the thorax by a part only of its transverse diameter. Inferior wings without distinct nervures. Body not contractile into a sphere. Abdomen compressed or depressed. Oviduct filiform. Palpi very short. Antennæ filiform, straight, from thirteen to sixteen-jointed.

FAMILY I. *Diplolepida.*

Abdomen very shortly, or not at all pedunculated.

538. Ibalia. GENUS DXXXVIII. IBALIA. Latreille, Illiger.
BANCHUS. Fabricius.
SAGARIS. Panzer.
CYNIPS. Jurine.

Abdomen very much compressed, knife-shaped. Antennæ filiform, joints cylindric.

Cultellator. *Sp.* 1. *Cultellator.*
Ibalia cultellator. Latreille.
Banchus cultellator. Fabricius.
Sigaris cultellator. Panzer.
Inhabits Germany and the south of France.

539. Diplolepis. GENUS DXXXIX. DIPLOLEPIS. Geoffroy, Olivier, Panzer, Illiger.
CYNIPS. Linnæus, Scopoli. Illiger.

Abdomen with the inferior part compressed, triangular-ovoid. Antennæ filiform, joints cylindric.

Quercus-folii. *Sp.* 1. *Quercus-folii.*
Cynips quercus-folii. Linnæus.
Diplolepis quercus-folii. Latr.
Inhabits Europe.

540. Figites. GENUS DXL. FIGITES. Latr. Jurine.
CYNIPS. Rossi.

Abdomen with its inferior part compressed, triangular-ovoid. Antennæ moniliform, thicker towards their extremities.

Scutellaris. *Sp.* 1. *Scutellaris.*
Figites scutellaris. Jurine, Latr.
Cynips scutellaris. Rossi.
Inhabits France and England.

FAMILY II. *Eucharida.*

Abdomen with a very distinct elongate peduncle.

541. Eucharis. GENUS DXLI. EUCHARIS. Latr. Fabr. Panzer, Spin.
CYNIPS. Olivier.
ICHNEUMON. Rossi.
CHALCIS. Jurine.

Ascendens. *Sp.* 1. *Ascendens.*
Eucharis ascendens. Latreille, Fabricius, Panzer.
Inhabits Germany.

TRIBE VI. CYNIPSIDES.

Abdomen attached to the thorax by a part only of its transverse diameter. Inferior wings without distinct nervures. Body not contractable into a ball. Abdomen compressed, or depressed. Oviduct filiform. Palpi very short. Antennæ broken, clavate, or gradually thicker externally, from six to twelve-jointed. Hinder feet formed for leaping.

FAMILY I. *Chalcida.*

Hinder tibiæ very much arcuated.

542. Leucospis. GENUS DXLII. LEUCOSPIS. Fabr. Oliv. Panz. Jurine, Illiger, Spinoli, Latr.
CYNIPS. De Latour.
VESPA. Sulzer, Christus.

Abdomen as if sessile, somewhat ovate, compressed, thicker above. Maxillary palpi with the second and third joints equally long. Superior wings longitudinally duplicated, with the marginal and the third submarginal cells distinct, abbreviated, open.

Gigas. *Sp.* 1. *Gigas.*
Leucospis gigas. Fabr. Latr.
Inhabits France and Germany.

543. Chalcis. GENUS DXLIII. CHALCIS. Fabr. Oliv. Panzer, Jurine, Illiger, Latr.
SPHEX. Linnæus.
VESPA. Linnæus.

Abdomen ovoid-triangular, not sessile, terminated by a point. Superior wings not folded, with the marginal and submarginal cells none or obliterated. Maxillary palpi, with the last joint but one shorter than the one before it.

* Abdomen with an elongate peduncle.

Clavipes. *Sp.* 1. *Clavipes.*
Chalcis clavipes. Latreille.
Inhabits Europe.

** Abdomen with a very short peduncle.

Minuta. *Sp.* 2. *Minuta.*
Chalcis minuta. Fabricius, Panzer, Latreille.
Inhabits Europe.

FAMILY II. *Cynipsida.*

Hinder tibiæ straight.

DIVISION I.

Anterior segment of the thorax large, forming a transverse quadrate, or triangular, with the apex obtuse or truncate.

Subdivision 1.

Mandibles with three or four teeth. Thorax with the anterior segment rounded. Antennæ with eight joints, and above.

544. Eu-rytoma. GENUS DXLIV. EURYTOMA. Illiger, Latreille.
ICHNEUMON. De Geer.
CYNIPS. Fabricius, Schrank.
DIPLOLEPIS. Fabricius.
EUCHARIS. Fabricius, Panzer.
CHALCIS. Jurine.
FIGITES. Spinoli.

Antennæ with distinct, somewhat rounded joints, verticillate-pilose in the males. Abdomen much compressed. Oviduct moderately exserted.

Serratulæ. *Sp.* 1. *Serratulæ.*
Cynips serratulæ. Fabricius.
Eucharis serratulæ. Panzer.
Eurytoma serratulæ. Latreille.
Inhabits Germany.

545. Cynips. GENUS DXLV. CYNIPS. Geoffroy, Schæff. Fabr. Olivier, Walck. Latreille.
ICHNEUMON. Linnæus.
DIPLOLEPIS. Fabr. Illiger, Spin.
CLEPTES. Fabricius.
CHALCIS. Cuvier, Lam. Jurine.

Antennæ with cylindric joints. Abdomen compressed. Oviduct exserted.

Capreæ. *Sp.* 1. *Capreæ.*
Cynips capreæ. Fabricius, Latreille.
Inhabits Europe.

Subdivision 2.

Mandibles with three or four teeth. Thorax with the anterior segment rounded. Antennæ six or seven-jointed, branched sometimes in the males.

546. Eu-lophus. GENUS DXLVI. EULOPHUS. Geoffroy, Olivier, Latr.
ICHNEUMON. Linnæus, De Geer, Spinoli.
DIPLOLEPIS. Fabricius, Spinoli.
CLEPTES. Fabricius.
CYNIPS. Christus, Jurine.
CHALCIS. Lamarck, Jurine.

Ramicorni *Sp.* 1. *Ramicornis.*
Diplolepis ramicornis. Fabr.
Eulophus ramicornis. Latr.
Inhabits Europe.

Subdivision 3.

Thorax with the anterior segment attenuated in front, somewhat conic. Mandibles bidentate.

547. Cle-nymus. GENUS DXLVII. CLEONYMUS. Latreille.
DIPLOLEPIS. Fabricius, Spinoli.
ICHNEUMON. De Geer, Rossi.

Antennæ inserted towards the middle of the face. Maxillary palpi with four, labial with three joints. Abdomen depressed, trigonate.

Depress *Sp.* 1. *Depressa.*
Diplolepis depressa. Fabricius.
Cleonymus depressus. Latreille.
Inhabits Europe.

548. Spa-langia. GENUS DXLVIII. SPALANGIA. Latreille, Spinoli.

Antennæ inserted near the mouth. Palpi biarticulate. Abdomen ovate-conic.

TRIBE I. FORMICARIDES.*

Abdomen with a peduncle abruptly formed, with a scale on two knots. Antennæ thicker towards their extremities, the first joint very long, more so in the females and neuters. Labrum large, perpendicular, corneous.

Obs. These insects live in societies consisting of vast numbers. The males and the females are furnished with wings, the neuters being apterous.

571. Formica. GENUS DLXXI. FORMICA of authors.

LASIUS. Fabricius.

Peduncle of the abdomen formed of one simple scale. Sting not punctorious. Poisonous glands in the females and neuters. Antennæ inserted in the front.

Herculanea. *Sp.* 1. *Herculanea.*

Formica herculanea. Latreille.

Inhabits the European woods, building a large nest with bits of sticks.

572. Polyergus. GENUS DLXXII. POLYERGUS. Latreille, Spinoli.

FORMICA. Jurine.

Peduncle of the abdomen formed of but one simple scale. Sting not punctorious. Poisonous glands in the females and neuters. Antennæ inserted near the mouth.

Rufescens. *Sp.* 1. *Rufescens.*

Polyergus rufescens. Latreille.

573. Ponera. GENUS DLXXIII. PONERA. Latreille, Illiger.

FORMICA. Linn. Fabr. De Geer, Olivier.

Peduncle of the abdomen formed of one scale or knot. Sting in females and the neuters.

* Mandibles of the neuters narrow, elongate, cheliform.

Genus ODONTOMACHUS of Latreille's old works. MYRMECIA, Fabricius.

Chelifera. *Sp.* 1. *Chelifera.*

Ponera chelifera. Latreille.

** Mandibles of the neuters broad and triangular.

Genus PONERA of Latreille's older works.

Crassinoda. *Sp.* 2. *Crassinoda.*

Formica crassinoda. Fabricius.

Ponera crassinoda. Latreille.

574. Atta. GENUS DLXXIV. ATTA. Fabr. Illig. Jur. Latr.

FORMICA. Linn. Fabricius, Villers.

Peduncle of the abdomen formed of two knots. Sting in the females and the neuters. Antennæ entirely exserted. Palpi very short; maxillary ones with six distinct joints. Head of the neuters very large.

* Mandibles of the neuters very narrow, and much elongated.

Genus ECITON of Latreille's older works; MYRMECIA, Fabricius.

Hamata. *Sp.* 1. *Hamata.*

Myrmecia hamata. Fabricius.

Atta hamata. Latreille.

** Mandibles of the neuters elongate-trigonate, much denticulated.

FORMICA of Latreille's older works; ATTA, Fabr.

Cephalotes. *Sp* 2. *Cephalotes.*

Atta cephalotes. Latreille, Fabricius.

*** Mandibles of the neuters short, trigonate, scarcely denticulated.

Genus FORMICA of Latreille's older works, and of Fabricius.

Capitata. *Sp.* 3. *Capitata.*

Atta capitata. Latreille.

575. Myrmica. GENUS DLXXV. MYRMICA. Latr. Spinoli.

FORMICA. Linn. Geoffroy, Panzer, Illiger.

MANICA. Jurine.

MYRMECIA. Fabricius.

Peduncle of the abdomen formed of two knots. Antennæ entirely exserted. Maxillary palpi long; six-jointed. Neuters and females armed with stings.

* Mandibles very narrow, very long: Antennæ filiform.

Sp. 1. *Forficata.* Forficata.

Myrmecia forficata. Fabr.

Myrmica forficata. Latr.

** Mandibles trigonate, but little elongate: Antennæ thicker towards their extremities.

a. Superior wings with three submarginal cells; the first and second perfect.

Sp. 2. *Subterranea.* Subterranea.

Mermica subterranea. Latr.

b. Superior wings with two submarginal cells; the first perfect.

Sp. 3. *Fugax.* Fugax.

Myrmeca fugax. Latreille.

GENUS DLXXVI. CRYPTOCERUS. Latr. Fabr. Illiger. 576. Cryptocerus.

FORMICA. Linn. Olivier.

MANICA. Jurine.

Peduncle of the abdomen formed of two knots. Antennæ with the first joint lodged in a lateral ridge of the head. Neutrals and females armed with a sting.

Sp. 1. *Atratus.* Atratus.

Cryptocerus atratus. Latr.

TRIBE II. MUTILLARIDES.

Antennæ filiform, vibratous, the first and third joints elongate.

The insects of this family are solitary. The males are winged, the females apterous, and there are no neuters.

FAMILY I. *Dorylida.*

Antennæ inserted at the mouth, the first joint very long. Head small. Abdomen cylindric, having the first joint nearly trigonate, with the superior sides more elevated, or transverse; rounded above, and separated from the following joint by an incision. Tibiæ slender, not spinose.

GENUS DLXXVII. LABIDUS. Latreille, Jurine. 577. Labidus.

Abdomen with the first segment nearly trigonate, with the sides elevated like a horse's shoe. Superior wings with three submarginal cells.

Sp. 1. *Latreillii.* Latreillii.

Labidus Latreille. Jurine.

Dorylus mediatus of Fabricius is probably to be referred to this genus.

GENUS DLXXVIII. DORYLUS.† Fabricius, Jurine, Illiger, Olivier, Latreille. 578. Dorylus.

Abdomen with the first segment transverse, rounded above, and separated from the following joint by an incision. Superior wings with two submarginal cells.

Sp. 1. *Helvolus.* Helvolus.

Dorylus helvolus. Fabricius, Latreille.

FAMILY II. *Mutillida.*

Antennæ inserted in the middle of the face. Head large. Abdomen somewhat conic or ovoid. Tibiæ spinose.

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* Huber has written a work on the economy of these animals.

† The males only of this and the preceding genus are known; the females are supposed to be apterous and solitary.

DIVISION I.

Abdomen with the two first segments nodiform. Superior wings with one submarginal cell.

579. APTEROGYNA. GENUS DLXXIX. APTEROGYNA. Latreille.

Antennæ setaceous, of the male as long as the body, of the females a little shorter. Mandibles arcutate. Maxillary palpi long.

Olivierii. *Sp.* 1. *Olivierii.*
Apterogyna Olivierii. Latr.
Inhabits Arabia.

DIVISION II.

Abdomen with the first segment of the abdomen nodiform. Superior wings with three submarginal cells.

Subdivision 1.

Maxillary palpi as long or longer than the maxillæ. Antennæ longer than the head, the first joint not receiving the second.

580. MUTILLA. GENUS DLXXX. MUTILLA. Linn. Fabricius, Panz. Jur. Illig. Spinoli.
SPHEX. De Geer.
APIS. Christus, Harris.

Abdomen (of both sexes) ovoid and convex, the second segment large, somewhat companulated. Thorax of the females cubical, with no transverse sutures.

Europæa. *Sp.* 1. *Europæa.*
Mutilla Europæa. Linn. Fabr. Panz. Latr.
Apis with no wings!! of Harris.
Inhabits Europe.

581. METHOCA. GENUS DLXXXI. METHOCA. Latreille.
MUTILLA. Jurine.

Abdomen (of the females) ovoid and convex, with the second segment large. Thorax composed of three segments, nodose.

Ichneumonoides. *Sp.* 1. *Ichneumonoides.*
Methoca Ichneumonoides. Latr.

582. MYRMOSA. GENUS DLXXXII. MYRMOSA. Latr. Jur. Panz.
MUTILLA. Rossi.
HYLÆUS. Fabricius.

Abdomen depressed, elliptic in the males, conic in the females. Thorax composed of two segments, the anterior segment transverse.

Melanocephala. *Sp.* 1. *Melanocephala.*
Myrmosa melanocephala. Latr.
Inhabits Europe.

583. SCHLERODERMUS. GENUS DLXXXIII. SCHLERODERMUS. Klug. Latr.

Abdomen of the females conic. Thorax divided into three segments by two transverse sutures, the hinder one elongate.

Domesticus. *Sp.* 1. *Domesticus.*
Schleroderınus domesticus. Klug. Latreille.

Subdivision 2.

Maxillary palpi shorter than the maxillæ. Antennæ slender, longer than the head; the first segment receiving the second.

584. MYRMECODES. GENUS DLXXXIV. MYRMECODES. Latreille.
TIPHIA. Fabricius.

Mandibles porrected, arcuate, edentulous. Palpi very short, three or four-jointed, the last joint obsolete; labial palpi shorter, scarcely visible, somewhat conic; labial ones cylindric. Antennæ not much longer than the head. Thorax elongate-cubic, a little narrowed behind, composed of three segments meeting together, the first segment largest.

Sp. 1. *Pedestris.*
Tiphia Pedestris. Fabricius.
Inhabits New Holland.

Subdivision 2.

Ocelli distinct, smooth. Wings never wanting.

TRIBE III. SCOLIDES.

Thorax with the first segment transverse quadrate, or forming an arc. Feet short, or moderately long; the hinder ones thick, spinulose, or strongly ciliated. Antennæ shorter than the head and trunk. Superior wings with the marginal cell detached from the apex; not doubled longitudinally.

FAMILY I. *Tiphida.*

Maxillary palpi long, with the joints very unequal. Antennæ with the first joint obconic.

GENUS DLXXXV. TIPHIA. Fabr. Panz. Illig. Jur. Spinoli.
SPHEX. Scopoli, Christus.
BETHYLLUS. Panzer.

Mandibles without teeth. Antennæ shorter than the thorax in both sexes. Abdomen ovate.

Sp. 1. *Femorata.*
Tiphia femorata. Fabr. Jur. Latr.
Bethyllus femoratus. Panzer.
Inhabits Europe.

GENUS DLXXXVI. TENGYRA. Latr.

Mandibles with two teeth. Antennæ of the males almost as long as the body. Abdomen of the males very much elongated, almost linear.

Sp. 1. *Sanvitali.*
Tingyra sanvitali. Latreille.
Inhabits Italy.

FAMILY II. *Scolida.*

Maxillary palpi short, joints equal. Antennæ with the first joint long, nearly cylindric.

DIVISION I.

Thorax with the anterior segment transverse-quadrate, the hinder margin straight or but little arcuated.

GENUS DLXXXVII. MIZINE. Latr. Illig. Spinoli.
PLESIA. Jurine.
ELIS. Fabricius.
TIPHIA. Fabr. Panzer.
SAPYGA. Jurine, Panzer.
SCOLIA. Rossi.

Mandibles bidentate.

Sp. 1. *Maculata.*
Tiphia maculata. Fabricius.
Mizine maculata. Latreille.
Sp. 2. *Volvulus.*
Elis volvulus. Fabricius.

GENUS DLXXXVIII. MERIA. Illiger, Latreille.
BETHYLUS. Fabricius.
TIPHIA. Rossi.
TACHUS. Jurine, Spinoli.

Mandibles without teeth.

Sp. 1. *Staphylinus.*
Tachus staphylinus. Jurine.
Meria staphylinus. Latreille.

DIVISION II.

Thorax with the anterior segment much contracted in the middle, and very much arcuated behind.

GENUS DLXXXIX. SCOLIA. Latreille.

Metabolia. * Superior wings with three submarginal cells, the last small; and two perfect discoidal cells. Four hinder tibiæ with acute spurs or heels.

Hortorum. *Sp.* 1. *Hortorum.*

Scolia hortorum. Fabricius, Latreille.

** Superior wings with three submarginal cells, the last small; and with three perfect discoidal cells. Hinder tibiæ with the heels broader at their extremities, and rounded.

Interrupta. *Sp.* 2. *Interrupta.*

Elis interrupta. Fabricius.

*** Superior wings with two submarginal cells, the second receiving two recurrent nervures: Three perfect discoidal cells: Tibiæ as in the last division.

Abdominalis. *Sp.* 3. *Abdominalis.*

Scolia abdominalis. Latreille.

**** Superior wings with two submarginal cells, the second receiving one recurrent nervure; two perfect discoidal cells, and one imperfect below: Four hinder tibiæ with acute heels.

Tridens. *Sp.* 4. *Tridens.*

Scolia tridens. Fabricius.

TRIBE IV. SAPYGIDES.

Thorax with the first segment forming an arch, or a transverse square. Feet moderate, or short, slender, not strongly ciliated or spined. Antennæ in both sexes as long as the head and the trunk. Superior wings with the marginal cell not remote; not folded longitudinally.

90. Sa-ryga. GENUS DXC. SAPYGA. Latr. Jur. Klug, Illiger, Spinoli.

APIS. Linn.

VESPA. Geoffroy.

HELLUS. Fabricius, Panzer.

SPHEX. Villers.

Mandibles very strong, trigonate, many-toothed. Antennæ thicker towards their extremities.

xpuncta-s. *Sp.* 1. *Sexpunctatus.*

Hellus sexpunctatus. Fabricius.

Inhabits Europe.

1. Poly-hrum. GENUS DXCI. POLYCHRUM. Spinoli, Latreille.

Mandibles very strong, trigonate, many-toothed. Antennæ filiform.

pandum. *Sp.* 1. *Repandum.*

Polychrum repandum. Spinoli, Latreille.

592. hynnus. GENUS DXCII. THYNNUS. Fabricius, Salzer, Latreille, Jurine, Donovan.

Mandibles (of the males) narrow, bidentate, arcuate. Antennæ slender, nearly setaceous.

ntatus. *Sp.* 1. *Dentatus.*

Thynnus dentatus. Fabr. Latr. Donovan.

Inhabits New Holland.

TRIBE V. POMPILIDES.

Thorax with the first segment forming an arch, or a transverse square. Feet long, the hinder ones as long as the head and trunk. Antennæ slender, formed of elongate, and slightly serrated joints. Superior wings not folding longitudinally.

FAMILY I. *Pompilida.*

Superior wings with three submarginal cells complete.

3. Pep-s. GENUS DXCIII. PEPSIS. Fabricius, Latreille.

POMPILUS. Jurine, Illiger.

Palpi equally long; the two last joints of the maxillary ones, and the last of the labial ones, shorter than the rest.

lata. *Sp.* 1. *Stellata.*

Pepsis stellata. Fabricius, Latreille.

Metabolia. 594. Pompilus. GENUS DXCIV. POMPILUS. Latreille.

Maxillary palpi longer than the labial ones, with the last joint thicker, conic-obovate; the three last joints nearly equally long. Labrum inserted under the clypeus. Antennæ (of the females at least,) with their points convoluted.

Obs. This artificial genus contains the following genera, proposed by the most learned writers on the hymenopterous insects, viz. 1. POMPILUS, Fabr. Panzer, Jur. Illig. Walck. Spin. 2. SPHEX, Linn. Scop. Vill. Cuv. Lam. 3. ICHNEUMON, Geoff. 4. PEPSIS, Fabr. 5. SALIUS, Fabr. 6. CRYPTOCHEILUS, Panzer. With the rejected genus 7. PSAMMOCHARES of Latreille.

Annulatus. *Sp.* 1. *Annulatus.*

Pompilus annulatus. Latr. Fabr.

Cryptocheilus annulatus. Panzer.

Viaticus. *Sp.* 2. *Viaticus.*

Pompilus viaticus. Latr. Fabr. Panzer.

Bicolor. *Sp.* 3. *Bicolor.*

Salius bicolor. Fabricius.

Pompilus bicolor. Latreille.

Dispar. *Sp.* 4. *Dispar.*

Pompilus dispar. Latreille.

Planiceps. *Sp.* 5. *Planiceps.*

Pompilus planiceps. Latreille.

595. Ceropales. GENUS DXCV. CEROPALES. Latr. Fabr. Jur. Panz. Spinoli.

EVANIA. Olivier, Villers, Rossi, Cuvier.

Maxillary palpi pendulous, longer than the maxillary ones; the three last joints equally long, the last joint thicker, conic-obovate. Labrum entirely exserted, entering to the anterior margin of the clypeus. Antennæ (in both sexes) thick, rigid, with the middle arcuated, not convoluted.

Maculata. *Sp.* 1. *Maculata.*

Ceropales maculata. Fabricius, Latreille.

FAMILY II. *Aphorida.*

Superior wings with two complete submarginal cells.

596. Aporus. GENUS DXCVI. APORUS. Spinoli, Latreille.

Superior wings with the second submarginal cell receiving two recurrent nervures.

Unicolor. *Sp.* 1. *Unicolor.*

Aporus unicolor. Spinoli, Latreille.

TRIBE VI. SPHECIDES.

Thorax with the first segment transverse linear. Feet long; the hinder ones as long as the head and trunk. Ocelli distinct. Superior wings not folding longitudinally.

FAMILY I. *Sphecida.*

Mandibles with their internal edge denticulated.

597. Amophila. GENUS DXCVII. AMOPHILA. Kirby, Latreille.

SPHEX. Linn. De Geer, Panzer, Lamarck, Cuvier, Jurine, Illiger, Spinoli.

PEPSIS. Fabricius, Spinoli.

MISCUS. Jurine.

Antennæ inserted about the middle of the face. Maxillæ and labrum much longer than the head, bent in the middle. Palpi very slender, with cylindric joints.

* Abdomen twice the length of the thorax, with the petiolus gradually formed, elongate, and two-jointed.

a. Superior wings with the third submarginal cell not petiolated.

Armata. *Sp.* 1. *Armata.*

Sphex armata. Rossi.

Amophila armata. Latreille.

Metabolia.

b. Superior wings with the third submarginal cell petiolated.

Campestris. *Sp.* 2. *Campestris.*
Amophila campestris. Latreille.
Inhabits sandy places.

** Abdomen as long (scarcely longer) as the thorax, peduncle short, abrupt.

Arenaria. *Sp.* 3. *Arenaria.*
Pepsis arenaria. Fabricius.
Amophila arenaria. Latreille.
Inhabits sandy ground.

598. SPHEX. GENUS DXCVIII. SPHEX. Linn. Fabr. Cuvier, Lamarck, Jurine, Illiger.
ICHNEUMON. Geoffroy.
APIS. Linn.
PRO-APIS. De Geer.
PEPSIS. Fabricius, Spinola.
CHLORION. Fabricius.

Antennæ inserted about the middle of the face. Maxillæ and labrum scarcely longer than the head, and bent towards their extremities. Maxillary palpi with all the joints elongate and obconic.

Flavipennis. *Sp.* 1. *Flavipennis.*
Pepsis flavipennis. Fabricius.
Sphex flavipennis. Latreille.

Obs. Pepsis pennsylvanica, and *Maxillosa,* with *Chlorion ichneumoneum* of Fabricius, are referable to this genus.

599. PRONÆUS. GENUS DXCIX. PRONÆUS. Latreille.
DRYINUS. Fabricius.
PEPSIS. Palisot de Beauvois.

Antennæ inserted at the mouth, (at the base of the clypeus?) Maxillary palpi filiform, longer than the labial palpi. Maxillæ terminated by a lanceolate lobe. Lip with the intermediate division elongate.

Æneus. *Sp.* 1. *Æneus.*
Dryinus æneus. Fabricius.
Pronæus æneus. Latreille.

600. CHLORION. GENUS DC. CHLORION. Latr. Fabricius, Panzer.
SPHEX. Christus, Cuvier.
PEPSIS. Illiger.
AMPULEX. Jurine.

Antennæ inserted at the mouth, (at the base of the clypeus?) Maxillary palpi filiform, longer than the labial ones. Maxillæ terminated by a short lobe. Lip with the divisions short, as if quadrioblate.

Lobatum. *Sp.* 1. *Lobatum.*
Clorion lobatum. Fabr. Latr.

601. DOLICHURUS. GENUS DCI. DOLICHURUS. Latreille.
PISON. Jurine.
POMPILUS. Spinola.

Antennæ inserted at the mouth, (at the base of the clypeus?) Maxillary palpi setaceous, longer than the labial ones.

Ater. *Sp.* 1. *Ater.*
Pompilus corniculus. Spinola.
Dolichurus ater. Latreille.

FAMILY II. *Pelopœida.*

Mandibles without teeth on their internal edges.

602. PODIUM. GENUS DCII. PODIUM. Fabricius, Latreille.

Antennæ inserted below the middle of the face. Clypeus broader than long. Maxillæ entirely coriaceous. Palpi nearly of equal length.

Rufipes. *Sp.* 1. *Rufipes.*
Podium rufipes. Fabr. Latr.

603. PELOPÆUS. GENUS DCIII. PELOPÆUS. Latreille, Fabr. Panzer. Spinola.
PEPSIS. Illiger.
SCELIPHRON. Klug.
SPHEX. Linn. Cuvier, Lamarck, Jurine.

Metabolia.

Antennæ inserted at the middle of the face. Clypeus with nearly equal diameters. Maxillæ with their extremities partly membranaceous. Maxillary palpi longer than the labial ones.

Spirifex. *Sp.* 1. *Spirifex.*
Sphex spirifex. Linn.
Pelopæus spirifex. Latreille.

Destillatorius. *Sp.* 2. *Destillatorius.*
Sphex spirifex. Panzer (*Faun. Ins. Germ.*)
Pelopæus destillatorius. Latreille.

Pensilis. *Sp.* 3. *Pensilis.*
Pelopæus pensilis. Latreille.

Tubifex. *Sp.* 4. *Tubifex.*
Pelopæus tubifex. Latreille.

Obs. The above four species are often confounded under the title of *Sphex spirifex* of Linnæus.

TRIBE VII. BEMBECIDES.

Thorax with the first segment transverse, linear. Feet short or moderately long. Labrum entirely exserted, very large. Ocelli very distinct. Superior wings not folded longitudinally.

604. BEM BEX. GENUS DCIV. BEMBEX. Fabricius, Olivier, Rossi, Cuvier, Lamarck, Panzer, Jurine, Illiger, Spinola.
APIS. Linn. Villers, Christus.
VESPA. Sulzer.

Labrum elongate-triangular. Mandibles simply unidentate on their internal edge. Maxillary palpi very short, four jointed. Superior wings with the marginal and the last submarginal cell almost meeting at their extremity, separated only by a very short angle.

Rostrata. *Sp.* 1. *Rostrata.*
Bembex rostrata. Fabricius, Panzer, Latreille.
Inhabits Germany.

605. Me DULA. GENUS DCV. MONEDULA. Latreille, Panzer.
VESPA. Linn. De Geer.
BEMBEX. Olivier, Jurine.
STICTIA. Illiger.

Labrum elongate-triangular. Mandibles with two or three denticules on their internal edge. Maxillary palpi as long as the maxillæ, composed of six-joints. Superior wings with the marginal and last submarginal cells divided by a very distint space.

Carolina *Sp.* 1. *Carolina.*
Bembex carolina. Fabricius.
Monedula carolina. Latreille.

606. St ZUS. GENUS DCVI. STIZUS. Latr. Jurine, Spinola.
BEMBEX. Olivier, Fabricius.
CRABRO. Rossi, Fabricius.
LARRA. Illiger, Fabricius.
SPHEX. Villers.
MELLINUS. Panzer.
LIRIS. Fabricius.
SCOLIA. Fabricius.

Labrum short, semicircular. Palpi filiform, maxillary ones longer, six-jointed; labial ones four-jointed.

Rufico *Sp.* 1. *Ruficornis.*
Larra ruficornis. Fabricius.
Monedula ruficornis. Latreille.

TRIBE VIII. LARRIDES.

Thorax with the first segment transverse-linear. Feet short or moderately long. Labrum entirely concealed, or but very obscure. Eyes elongate, reaching the hinder margin. Ocelli very distinct. Antennæ inserted near the mouth; the first joint obovoid, or in-

Metabolia. serted in the middle of the face. Superior wings not folding longitudinally.

FAMILY I. *Larrida.*

Superior wings with two or three submarginal cells complete.

DIVISION I.

Eyes entire, not emarginate. Mandibles without an emargination on their internal edge.

Subdivision 1.

Antennæ thicker externally. Eyes separate.

07. Gorytes. GENUS DCVII. GORYTES. Latreille, Illiger, Spin.
MELLINUS. Fabricius, Walckenaer.
VESPA. Linn. Geoffroy.
SPHEX. Rossi.
ARPACTUS. Jurine, Panzer.
OXYBELUS. Fabricius.

Antennæ inserted below the middle of the face. Mandibles unidentate. Superior wings with the second submarginal cell sessile.

inquecinctus. *Sp.* 1. *Quinquecinctus.*
Gorytes quinquecinctus. Latreille.

8. Nysson. GENUS DCVIII. NYSSON. Latreille, Jurine, Panzer, Illiger, Spinola.
CRABRO. Fabr. Olivier, Rossi.
OXYBELUS. Fabricius.
POMPILUS. Fabr.
MELLINUS. Fabr.
SPHEX. Villers.

Antennæ inserted below the middle of the face. Mandibles without teeth. Superior wings with the second submarginal cell petiolated.

inosus. *Sp.* 1. *Spinosus.*
Nysson spinosus. Latreille.

9. Psen. GENUS DCIX. PSEN. Latr. Jurine, Panzer, Illiger, Spinola.
PELOPÆUS. Fabr.
TRYPOXYLON. Fabr.

Antennæ inserted in the middle of the face, towards the front. Abdomen with the peduncle abrupt and short.

r. *Sp.* 1. *Ater.*
Psen ater. Latreille.
Trypoxylon atratum. Fabr.
Inhabits Europe.

Subdivision 2.

Eyes meeting behind. Antennæ filiform.

Astata. GENUS DCX. ASTATA. Latr. Spinola.
SPHEX. Villers, Rossi.
DIMORPHA. Jurine, Panzer, Illiger.

Antennæ inserted towards the mouth, at the base of the clypeus.

DIVISION II.

Eyes entire, not emarginate. Mandibles emarginate on their internal edge.

Subdivision 1.

Superior wings with three submarginal cells.

Palarus. GENUS DCXI. PALARUS. Latreille.
GONIUS. Jurine, Panzer.
PHILANTHUS. Fabr.
CRABRO. Rossi.

Antennæ very short, thicker towards their tips. Clypeus divided into three parts by two impressed lines. Superior wings with the second submarginal cell petiolated. Metabolia.

Flavipes. *Sp.* 1. *Flavipes.*
Palarus flavipes. Latr.
Philanthus flavipes. Fabr.

612. Larra. GENUS DCXII. LARRA. Fabricius, Olivier, Jurine, Panzer, Spinola, Latreille.
LIRIS. Fabricius, Illiger.
SPHEX. Villers, Rossi.

Antennæ filiform. Superior wings with the third submarginal cell narrow, almost lunate. Mandibles without a tooth-like process on their internal edge.

Ichneumoniformis. *Sp.* 1. *Ichneumoniformis.*
Larra ichneumoniformis. Panzer, Fabr. Latr.

613. Lyrops. GENUS DCXIII. LYROPS. Illiger, Latreille.
TACHYTES. Panzer.
LARRA. Fabricius, Jurine.
LIRIS. Fabr.
ANDRENA. Rossi.

Antennæ filiform. Superior wings with the third submarginal cell narrow, almost lunate. Mandibles with a strong tooth on their internal edge.

Tricolor. *Sp.* 1. *Tricolor.*
Larra tricolor. Fabr.
Tachytes tricolor. Panzer.
Inhabits Germany.

Subdivision 2.

Superior wings with two submarginal cells.

614. Dinetus. GENUS DCXIV. DINETUS. Jurine, Panzer, Illiger, Latreille.
SPHEX. Schæffer.
POMPILUS. Fabricius.
CRABRO. Rossi.

Antennæ, (of the males,) moniliform, terminated by elongate, cylindric joints, convoluted in the middle. Mandibles acutely unidentate on their internal edge. Superior wings with the marginal cell appendiculated; the two submarginal cells sessile.

Pictus. *Sp.* 1. *Pictus.*
Dinetus pictus. Jurine, Panzer, Latreille.

615. Miscophus. GENUS DCXV. MISCOPHUS. Jurine, Latreille.

Antennæ with the joints alike in both sexes. Mandibles without distinct teeth. Superior wings with the second submarginal cell petiolated.

Bicolor. *Sp.* 1. *Bicolor.*
Miscophus bicolor. Jurine, Latreille.
Inhabits France.

DIVISION III.

Eyes notched.

616. Pison. GENUS DCXVI. PISON. Jurine, Latreille.
TACHYBULUS. Latreille's older works.
ALYSON. Spinola.

Superior wings with three distinct submarginal cells. Abdomen conic, with a very short, almost imperceptible peduncle.

Ater. *Sp.* 1. *Ater.*
Pison niger. Latreille.
Alyson ater. Spinola.
Tachybulus ater. Latr. *Gen. Crust. et Ins.* 4. p. 75.

617. Trypoxylon. GENUS DCXVII. TRYPOXYLON. Latreille, Fabricius, Panzer, Illiger, Spinola.
SPHEX. Linnæus, Vill. Cuv. Rossi, Christus.
APIUS. Jurine.

Superior wings with three submarginal perfect cells; the first distinct, receiving a recurrent nervure; the second obsolete, much smaller, receiving another ner-

Metabolia. vure; the third also obsolete, terminal. Abdomen long and gradually pedunculated.

FAMILY I. *Oxybellida.*

Superior wings with one complete submarginal cell.

618. Nitela. GENUS DCXVIII. NITELA. Latreille.

Antennæ filiform nearly straight, longer than the head, the second and third joints nearly of equal length. Mandibles bidentate at their extremities. Tibiæ not spinose. Tarsi with small *pulvilli*.

Spinolæ. *Sp.* 1. *Spinolæ.*
Nitela Spinolæ. Latreille.
Inhabits the south of France.

619. Oxybelus. GENUS DCXIX. OXYBELUS. Latreille, Fabricius, Panzer, Jurine, Illiger, Spinola.

VESPA. Linnæus, Villers, Christus.
SPHEX. Schæffer.
CRABRO. Olivier, Rossi.

Antennæ thicker towards their extremities, longer than the head, convoluted, the second joint much shorter than the third. Mandibles without teeth at their extremities. Tibiæ spinose. Tarsi with large *pulvilli*.

Uniglumis. *Sp.* 1. *Uniglumis.*
Vespa uniglumis. Linn.
Oxybelus uniglumis. Fabricius, Latreille.
Inhabits Europe.

TRIBE IX. CRABRONIDES.

Thorax with the first segment transverse-linear. Feet short, or moderately long. Labrum entirely concealed or but obscure. Eyes not reaching the hinder part of the head. Ocelli very distinct. Superior wings not folded longitudinally. Antennæ inserted at the mouth with the first joint cylindric or conic, or towards the middle of the face.

FAMILY I. *Crabronida.*

Superior wings with one or two complete submarginal cells.

DIVISION I.

Mandibles with their extremities bifid. Superior wings with but one recurrent nervure.

620. Crabro. GENUS DCXX. CRABRO. Fabricius, Olivier, Rossi, Jurine, Panzer, Illiger, Spinola.

SPHEX. Linn. Villers.
VESPA. Linn. Geoffroy.
PEMPHREDON. Fabricius, Spinola.

Antennæ with the first joint long and cylindric. Superior wings with one complete submarginal cell.

Cribrarius. *Sp.* 1. *Cribrarius.*
Crabro cribrarius. Fabricius, Latreille.
Inhabits Europe.

Subterraneus. *Sp.* 2. *Subterraneus.*
Crabro subterraneus. Fabricius, Latreille.
Inhabits Europe.

Tibialis. *Sp.* 3. *Tibialis.*
Pemphredon tibialis. Fabricius.
Inhabits Europe.

Obs. These three species may be considered as the types of as many genera.

621. Stigmus. GENUS DCXXI. STIGMUS. Jurine, Panzer, Illiger, Spinola, Latreille.

Antennæ with the first joint obconic. Superior wings with two complete submarginal cells; and two discoidal cells.

Ater. *Sp.* 1. *Ater.*
Stigmus ater. Jurine, Latreille.

622. Cemonus. GENUS DCXXII. CEMONUS. Jurine.

PSEN. Panzer. Metabolia.
PEMPHEDRON. Fabricius.
STIGMUS. Latreille.

Antennæ with the first joint obconic. Superior wings with two complete submarginal, and three discoidal cells.

Sp. 1. *Minutus.* Minutus.
Pemphredon minutus. Fabricius.
Psen pallipes. Panzer.
Cemonus minutus. Jurine.
Stigmus minutus. Latreille.
Inhabits Europe.

DIVISION II.

Mandibles strong, many-toothed. Superior wings with two recurrent nervures.

GENUS DCXXIII. PEMPHEDRON. Latreille, Fabricius, Spinola. 623. Pe phedron.

CEMONUS. Jurine, Panzer, Illiger.

Superior wings with the submarginal cell not narrower towards the apex. Antennæ with the first joint longest, thickest.

Sp. 1. *Unicolor.* Unicolor.
Pemphedron unicolor. Latreille.
Cemonus unicolor. Jurine.
Inhabits Europe.

FAMILY II. *Mellinida.*

Superior wings with three complete submarginal cells.

DIVISION I.

Antennæ inserted at the mouth, filiform. Clypeus not trilobate.

GENUS DCXXIV. MELLINUS. Fabricius, Panzer, Jurine, Illiger, Spinola. 624. M linus.

SPHEX. De Geer, Cuvier, Villers.
VESPA. Linn. Rossi, Harris.

Superior wings with all the submarginal cells sessile. Abdomen distinctly pedunculated. Tarsi terminated by a thick joint, bearing a large *pulvillus*.

Sp. 1. *Ruficornis.* Rufic
Mellinus ruficornis. Fabr. Panzer, Latreille.
Inhabits Europe.

GENUS DCXXV. ALYSON. Jurine, Panz. Latr. 625. A son.

POMPILUS. Fabricius.

Superior wings with the second submarginal cell petiolated. Abdomen with a short peduncle. Tarsi with a small pulvillus.

Sp. 1. *Lunicornis.* Lunic
Pompilus lunicornis. Fabricius.
Alyson lunicornis. Panzer, Latreille.
Inhabits Europe.

DIVISION II.

Antennæ thicker towards their extremities, inserted about the middle of the face. Clypeus trilobate.

GENUS DCXXVI. CERCERIS. Latr. Illig. Spinola. 626. C ris.

SPHEX. Schæffer, Villers, Rossi.
VESPA. Geoffroy, Olivier, Harris.
PHILANTHUS. Fabricius, Jurine, Panzer.
BEMBEX. Rossi.
CRABRO. Rossi.

Antennæ gradually thicker externally, very much approximating at their base, almost as long as the thorax, the third joint somewhat cylindric. Mandibles with a tooth in their internal edge. Superior wings with the second submarginal cell petiolated.

Sp. 1. *Major.* Maj

Metabolia. *Cerceris major.* Spinola, Latreille.

Quadricinctus. *Sp.* 1. *Quadricinctus.*

Philanthus quadricinctus. Fabricius, Panzer.

Inhabits Europe.

627. Philanthus. Genus DCXXVII. Philanthus. Fabr. Panzer, Illiger, Jurine, Spinola, Latreille.

Vespa. Geoffroy, Villers.

Sphex. Schæffer.

Crabro. Rossi.

Simblephilus. Jurine.

Antennæ distant, abruptly thicker towards their extremities. Mandibles without any process in their internal edge. Superior wings with all the submarginal cells sessile.

Coronatus. *Sp.* 1. *Coronatus.*

Philanthus coronatus. Fabricius, Panzer, Latreille.

Inhabits Europe.

Tribe X. Vespides.

Superior wings folded longitudinally. Thorax, with the first segment forming an arc, prolonged behind even to the origin of the superior wings. Antennæ twelve-jointed, with their extremities pointed. Lip with three glandiliferous divisions, or with four long plumose setæ.

Family I. *Eumenida.*

(Solitary wasps.)

Mandibles longer than broad, anteriorly meeting like a rostrum. Lip with the intermediate division narrow, and very long. Clypeus cordiform, with the point porrected, and more or less truncated.

Division I.

Lip without glands at their extremity, divided into four very long linear and plumose divisions. Mandibles of the male very large.

Syna- Genus DCXXVIII. Synagris. Latreille, Fabricius.

Vespa. Olivier, Jurine.

Palpi four-jointed; maxillary ones very short, labial ones longest. Abdomen ovate-conic, the two anterior segments not coarctate.

Sp. 1. *Cornuta.*

Synagris cornuta. Fabricius, Latreille.

Division II.

Lip having four glandular points at its extremity, parted into three pieces, the middle one large, and bifid or notched at its extremity.

Subdivision 1.

Superior wings doubled, three submarginal cells complete. Maxillary palpi six-jointed, not very much shorter than the labial ones.

Ryc- Genus DCXXIX. Rygchium. Spinola.

Odynerus. Latreille.

Vespa. Fabricius.

Abdomen ovoid-conic, the first segment not, or scarcely, narrower than the second. Maxillary palpi, with the last joint scarcely longer than the terminal process of the maxillæ; labial palpi smooth, the last joint distinct, the first evidently longer than the second. Maxillæ with their process very long and narrow.

Sp. 1. *Europæum.*

Rygchium Europæum. Spinola.

Vespa oculata. Fabricius.

Odynerus Europæus. Latreille.

Inhabits Europe.

Genus DCXXX. Pterochilus. Klug. Panzer. Metabolia. 630. Pterochilus.

Odynerus. Latreille.

Vespa. Panzer.

Abdomen ovoid-conic. Labium very long. Maxillary palpi, with the last joint not extending beyond the extremity of the maxillæ; labial palpi hairy, the fourth joint obtuse, scarcely visible. Maxillæ with the terminal lobe narrow and long.

Sp. 1. *Phaleratus.* Phaleratus.

Pterochilus phaleratus. Klug.

Vespa phalerata. Panzer.

Odynerus phaleratus. Latreille.

Inhabits Europe.

Genus DCXXXI. Odynerus. Latreille. 631. Odynerus.

Vespa. Panzer, Fabricius.

Abdomen ovoid-conic, the second segment broader than the first. Maxillary palpi, with two or three of the joints extending beyond the extremity of the maxillæ. Maxillæ with the terminal lobe short, short-lance shaped.

Sp. 1. *Spinipes.* Spinipes.

Vespa spinipes. Panzer, Fabricius.

Odynerus spinipes. Latreille.

Inhabits Europe.

Genus DCXXXII. Eumenes. Latreille, Fabricius. 632. Eumenes.

Abdomen with the first segment contracted into an elongate peduncle, the second segment campanulated. Clypeus longitudinal, anteriorly produced into a point. Mandibles forming by their junction a long-pointed rostrum.

Sp. 1. *Coarctata.* Coarctata.

Eumenes coarctata. Fabricius, Latreille.

Inhabits Europe.

Genus DCXXXIII. Zethus. Fabricius, Latreille. 633. Zethus.

Clypeus as broad, or broader than long, without any remarkable production in front. Maxillary palpi shorter than the maxillæ.

Sp. 1. *Cœruleo-pennis.* Cœruleo-pennis.

Zethus cœruleo-pennis. Latreille, Fabricius.

Genus DCXXXIV. Discœlius. Latreille. 634. Discœlius.

Vespa. Panzer.

Clypeus as broad, or broader than long, without any remarkable protuberance before. Maxillary palpi longer than the maxillæ.

Sp. 1. *Zonalis.* Zonalis.

Vespa zonalis. Panzer.

Discœlius zonalis. Latr.

Inhabits Europe.

Subdivision 2.

Superior wings extended, two submarginal cells complete. Maxillary palpi with less than six joints, shorter than the labial ones.

Genus DCXXXV. Ceramius. Latreille. 635. Ceramius.

Sp. 1. *Fonscolumbii.*

Ceramius Fonscolumbii. Latreille. Fonscolumbii.

Family II. *Vespida.*

(Social wasps.)

Mandibles longer than broad, long-quadrate, with their extremities obliquely truncated. Clypeus almost quadrate. Lip with the intermediate division a little lengthened, cordiform.

Genus DCXXXVI. Polistes. Latreille, Fabricius, Illiger, Spinola. 636. Polistes.

Vespa. Linnæus, Geoffroy, Panzer, Jurine.

Mandibles (at least of the females and neuters) with their internal edge armed with three equal teeth, the upper one shorter, emarginated, acute or obtuse. Clypeus, with the middle of the anterior margin, produced into a little acute entire tooth. Abdomen oval or elliptic, in many with a long peduncle.

Gallica.

Sp. 1. *Gallica.*
Polistes gallica. Fabricius, Latreille.
Inhabits Europe.

637. Vespa.

GENUS DCXXXVII. VESPA of authors.

Mandibles (at least of the females and neuters) with the second tooth much broader than the two under ones, the upper one obtuse. Clypeus with the anterior margin broadly truncate, and somewhat emarginate, with a tooth on each side. Abdomen ovoid-conic, with the base abruptly truncated, and very shortly pedunculated.

Crabro.

Sp. 1. *Crabro.* (Hornet.)
Vespa crabro. Linnæus, Fabricius, Latreille, &c.
Inhabits Europe, building its nest in hollow trees.

Vulgaris.

Sp. 2. *Vulgaris.* (Common wasp.)
Vespa vulgaris. Linnæus, Fabricius, &c.
Inhabits Europe, building its nest in holes under ground.

Britannica.

Sp. 3. *Britannica.*
Vespa Britannica. Leach, *Zool. Mis.*
Inhabits Britain, and builds a nest suspended from trees.

TRIBE XI. MASARIDES.

Superior wings doubled longitudinally. Thorax with the first segment forming an arc, prolonged behind even to the base of the superior wings. Antennæ eight-jointed or more, terminated by a club. Lip without any glandular points, long, filiform, tubulose, beneath with two linear elongate laciniæ.

638. Masaris.

GENUS DCXXXVIII. MASARIS. Fabricius, Latr.

Antennæ (of the male) as long as the head and trunk, eight-jointed, the last joint thicker, obconic. Abdomen much elongated.

Vespiformis.

Sp. 1. *Vespiformis.*
Masaris vespiformis. Fabricius, Latreille.
Inhabits Barbary.

639. Chelonites.

GENUS DCXXXIX. CHELONITES. Latreille, Fabricius, Illiger, Spinola, Panzer.
MASARIS. Jurine, Cuvier, Lamarck.
CHRYSIS. Rossi.
VESPA. Villers.
CIMBEX. Oliv.

Antennæ eight-jointed, longer than the head, the eighth joint with the following joints forming an obconic club. Abdomen a little longer than the trunk.

Apiformis.

Sp. 1. *Apiformis.*
Chelonites apiformis. Fabricius, Panzer, Latreille.
Masaris apiformis. Jurine.
Vespa abbreviata. Villers.
Cimbex vespiformis. Olivier.
Inhabits Italy and the south of France.

DIVISION II.

Hinder feet pollenigerous; their tarsi, with the first joint, very large, and compressed, elongate-quadrate, or obtrigonous. Larvæ pollenivorous.

TRIBE XII. ANDRENIDES.

Lip with the apex subcordate or subhastate, on each side with one auricle; nearly straight, or slightly incurved in some, reflexed in others, shorter than the sheathing tube. Palpi alike.

FAMILY I. *Prosopida.*

Lip with the apex dilated, somewhat cordiform.

640. Co LETES.

GENUS DCXL. COLLETES. Latreille, Illiger, Spinola, Klug.
APIS. Linnæus, Olivier, Villers.
ANDRENA. Fabricius, Jurine.
HYLÆUS. Cuvier.
EVODIA. Panzer.
MELITTA. * *a.* Kirby.

Hinder feet pollenigerous. Superior wings with three submarginal cells. Antennæ with the third joint longer than the second. Abdomen much elongated, more or less villose. Ocelli forming a curved line. Tongue obtuse, the apex bilobate.

The shape of the tongue is admirably adapted for the construction of its cells, which are described by the accurate Reaumur in the fifth memoir of his sixth volume, "*dont les nids sont faits d'especes de membranes soyeuses.*" According to this author, they make their nests in the earth that fills the cavities of certain stone walls. Some of them choose a northern aspect sheltered by trees. These nests are cylindrical, and consist of from two to four cells placed end to end, each of which is formed like a thimble, the end of one fitting into the other. The cells vary in size. The cylinder runs in a horizontal direction; but sometimes, from the intervention of a stone or of some other obstacle, it takes a different course, so that the last cell forms an angle with the first. The cells are composed of many layers of a very thin and transparent membrane, and the colour is generally reddish brown, which arises from the substance with which they are constructed. This is sometimes nearly liquid, at others it is merely a paste composed of pollen and honey. The larva, when hatched, very soon imbibes all that is liquid, and when full grown quite fills its cell. The substance with which they form their cells has not been ascertained; but Reaumur conjectures it to be a secretion from the insect.

Succincta.

Sp. 1. *Succincta.*
Colletes succincta. Latreille.
Melitta succincta. Kirby.
Evodia calendarum. Panzer.
Andrena succincta. Fabricius.
Inhabits Europe.

Fodiens.

Sp. 2. *Fodiens.*
Colletes fodiens. Latr.
Melitta fodiens. Kirby.
Inhabits Europe.

641. Pr sopis.

GENUS DCXLI. PROSOPIS. Jurine, Fabricius, Illiger, Panzer, Spinoli, Klug.
HYLÆUS. Latreille, Cuvier, Walckenaer.
APIS. Linn. Geoff.
ANDRENA. Olivier.
VESPA. Rossi.

Hinder feet not pollenigerous. Superior wings with two submarginal cells. Antennæ with the second and third joints nearly equally long. Abdomen conic, gibbous above. Tongue obtuse, the apex truncated, on each side auriculated. Ocelli placed in a triangle.

Obs. The insects of this genus, when pressed between the fingers, emit an agreeable odour.

FAMILY II. *Andrenidæ.*

Lip with the intermediate process lanceolate, acute.

DIVISION I.

Lip when at rest reflexed.

Subdivision 1.

Superior wings with two submarginal cells.

642. poda.

GENUS DCXLII. DASYPODA. Latreille, Fabricius, Panzer, Illiger, Spinola, Klug.

Metabolia.

Andrena. Rossi.

Apis. Christus.

Trachusa. Jurine.

Melitta. Kirby. Maxillæ inflexed at their middle, or below, their terminal process triangular-lanceolate, and longer than their palpi. Hinder feet, with the first joint of their tarsi as long, or longer than the tibiæ.

Hirtipes. *Sp.* 1. *Hirtipes.*

Dasypoda hirtipes. Fabricius, Panzer, Latreille.

Inhabits Europe.

Plumipes. *Sp.* 2. *Plumipes.*

Dasypoda plumipes. Panzer.

Melitta Swammerdamella. Kirby.

Inhabits Europe. It was first noticed by the illustrious Swammerdam. They burrow in sandy soil, throwing up a heap of sand without their hole.

Subdivision 2.

Superior wings with three submarginal cells, the second small.

643. An-drena. **Genus DCXLIII. Andrena.** Fabricius, Panzer, Jurine, Illiger, Spinola, Klug.

Apis. Linnæus, Villers.

Melitta. ** *c.* Kirby.

Maxillæ bent at their extremity, their terminal lobe scarcely longer than broad. Hinder feet, with the first joint of their tarsi shorter than the tibiæ. Labium or lip little elongate, shorter than its palpi.

The species of this genus are extremely numerous, and a very large portion of them inhabit Britain. Their proboscis is downy and thick. The hinder legs of the male are furnished with a flocculus at their base, the tibiæ with a thick scopa or brush, and their anus is covered by a fringe of hairs. They nidificate under ground in a light soil, some choosing banks over which bushes are scattered, others bare perpendicular sections, but all seem to prefer a southern aspect. They excavate burrows of a cylindric form, from five inches to nearly a foot or more in depth, of such a diameter only as to admit the insect. In making these holes, they remove the earth grain by grain, which they throw up on the outside of their holes in the form of a hillock. Some species penetrate in a horizontal, and others in a perpendicular direction. They construct a cell at the bottom of this hole, which they replenish with pollen made into a paste with honey, and in this they deposit their eggs. The pollen they carry in the scopa or brush of their hinder tibiæ, upon the flocculus at the base of the hinder thighs, and on the hairs of the metathorax. When the female has committed her egg to the paste, she very carefully stops the mouth of her hole, to prevent the ingress of ants, or of other insects who might be enemies to the larva.

44. Cilis- **Genus DCXLIV. Cilissa.** Leach's MSS.

Melitta. Kirby.

Andrena. Latreille, Panzer.

Maxillæ bent near their middle, the terminal process very much longer than broad. Lip elongate, longer than its palpi. Superior wings with three submarginal cells, the second small.

This genus is not only distinguished from *Andrena* by the characters of the lip and maxillæ, but also by having a longer tongue with very minute auricles, and the tops of the valves cultriform.

icincta. *Sp.* 1. *Tricincta.*

Melitta tricincta. Kirby.

Andrena tricincta. Latreille.

Cilissa tricincta. Leach's MSS.

Inhabits England.

Metabolia.

Hæmorrhoidalis. *Sp.* 2. *Hæmorrhoidalis.*

Andrena hæmorrhoidalis. Panzer.

Melitta chrysura. Kirby.

Inhabits Germany and England.

Division II.

Lip with the intermediate division incurved, or nearly straight. Superior wings in all with three complete submarginal cells.

Subdivision 1.

Lip with the intermediate division nearly straight, not twice the length of the head.

645. Sphecodes. **Genus DCXLV. Sphecodes.** Latreille.

Sphex. Linnæus, Villers, Rossi.

Apis. Geoffroy.

Proapis. De Geer.

Nomada. Fabricius.

Andrena. Olivier, Panzer, Jurine, Spinola.

Dichroa. Illiger, Klug.

Melitta. ** *a.* Kirby.

Labrum trigonate, of the male entire, of the female generally emarginate. Antennæ of the males long, almost moniliform, arcuated. Abdomen with the greater portion smooth.

The species of *Sphecodes* at first sight, bear a near resemblance to *Sphex.* They make their nests in bare sections of banks exposed to the sun, and nearly vertical. According to Reaumur, they excavate to the depth of nine or ten inches, and deposit their eggs in a mass of pollen mixed with honey.

Gibbus. *Sp.* 1. *Gibbus.*

Sphecodes gibbus. Latreille.

Nomada gibba. Fabricius.

Melitta gibba. Kirby.

Dichroa analis. Illiger.

Inhabits Europe.

Subdivision 2.

Lip with the intermediate division incurved, longer than the lateral ones, and twice as long or more than the head.

646. Hylæus. **Genus DCXLVI. Hylæus.** Fabr. Illig. Spin. Klug.

Apis. Linnæus, Villers, Rossi.

Andrena. Olivier, Panzer, Jurine, Spinola.

Hylæus. Fabricius, Illiger, Klug.

Melitta. ** *b.* Kirby.

Halictus. Latreille.

Lip lanceolate, little sericeous. Hinder feet in both sexes alike. Anus of the females with a longitudinal groove above.

The males of this genus are remarkable for an elongate cylindric body. The wings of many of the species are beautifully iridescent. They nidificate in bare banks.

Sexcinctus. *Sp.* 1. *Sexcinctus.*

Hylæus sexcinctus. Fabricius.

Halictus sexcinctus. Latreille.

Inhabits Europe.

647. Nomia. **Genus DCXLVII. Nomia.** Latreille.

Megilla. Fabricius.

Lasius. Jurine, Panzer.

Lip very hairy, or tomentose. Hinder feet of the male with dilated incrassated tibiæ and thighs.

Diversipes. *Sp.* 1. *Diversipes.*

Nomia diversipes. Latreille.

Megilla curvipes? Fabricius.

Difformis. *Sp.* 2. *Difformis.*

Lasius difformis. Jurine, Panzer.

Inhabits Germany.

TRIBE XIII. APIDES.

Lip with the apex inflected, the intermediate lacinia filiform, and very long. Labial palpi, with the two first joints resembling a compressed seta.

FAMILY I. *Panurgida.*

(Solitary bees.)

Hinder tarsi with the first joint nearly equally broad, or gradually narrowing from the base to the apex, the second joint originating from the middle of its apex.

DIVISION I.

Palpi alike.

648. Systropha. GENUS DCXLVIII. SYSTROPHA. Illiger, Klug.
APIS. Schæffer, Rossi.
EUCERA. Scopoli.
ANDRENA. Olivier.
HYLÆUS. Fabricius.
CERATINA. Jurine.
ANTHIDIUM. Panzer.

Mandibles bidentate. Superior wings with three complete submarginal cells. Ocelli disposed in transverse straight lines. Antennæ filiform, elongate; the apex convoluted in the males, of the females elongate-clavate, the apex acuminate.

Spiralis. *Sp.* 1. *Spiralis.* *
Systropha spiralis. Illiger.
Andrena spiralis. Olivier.
Hylæus spiralis. Fabricius.
Anthidium spirale. Panzer.
Inhabits Europe.

649. Panurgus. GENUS DCXLIX. PANURGUS. Panzer, Spinola, Latr.
APIS. Scopoli.
DASYPODA. Illiger, Fabricius.
APIS. Kirby. * *a.*
ERIOPS. Klug.

Mandibles not dentated. Antennæ straight in both sexes, and subclavate. Superior wings with two submarginal cells. Ocelli disposed in a triangle.

Lobatus. *Sp.* 1. *Lobatus.*
Panurgus lobatus. Panzer.
Dasypoda lobata. Fabr.
Inhabits Europe.

DIVISION II.

Palpi unequal; the labial palpi setiform.

Subdivision 1.

Labrum nearly quadrate, transverse, or not much longer than broad. Mandibles tridentate at their points. (Superior wings with three submarginal cells).

650 Xylocopa. GENUS DCL. XYLOCOPA. Latr. Illiger, Panzer, Jur. Klug. Spinola, Fabr.
APIS. Linn. Geoff. Vill. Rossi, Kirby. (** *d.* 2. *β*).
BOMBUS. Fabr.
CENTRIS. Fabr.

Labrum transverse, abruptly carinated transversely, the anterior margin ciliated, emarginated. Antennæ filiform, with the scapus very long.

The wings of this genus are generally violet coloured, and composed of a substance between membrane and corium.

Violacea. *Sp.* 1. *Violacea.*
Xylocopa violacea. Fabr. Panzer, and Latr.
Apis violacea. Linn.
Inhabits Europe.

The following account of the economy of this species is extracted from Reaumur. "The mother bee usually makes her appearance in the spring, as soon as the winter is over; she may then be met with in gardens, visiting such walls as are covered with trees trained on trellis-work, in a sunny aspect. When once she has begun to make her appearance, she frequently returns, and for a long period may be known by her size, and her humming noise, which much resembles that of the genus *Bombus*. The object of these early visits is to fix upon a piece of wood calculated for her purposes. She generally selects the putrescent supporters of arbours, or vine-props, and will sometimes attack garden-seats, thick doors, and window-shutters; but she generally (if not always) selects a piece cylindrical and perpendicular. With her strong mandibles she bores into it, directing her course obliquely downwards, then proceeding in a direction parallel with its sides, till she has bored a cylindric hole from twelve to fifteen inches in length, and seven or eight lines in diameter. Sometimes three or four tunnels are bored in the same piece, nearly parallel with each other. A passage is left where she enters, or first begins to bore, and another at the end of the pipe. As the industrious animal proceeds in her employment, she clears away the wood which she detaches, throwing it out upon the ground, where it appears like a small heap of saw-dust. Thus we see she has prepared a long cylinder in the midst of the wood, sheltered from the weather and from external injuries, and fitted for her purposes. She now enters to the bottom of the cylinder, and deposits an egg, and then lays in a store of pollen mixed with honey, sufficient for the nutriment of the larva when hatched. At the height of seven or eight lines, which is the depth of each cell, she next constructs, of particles of the saw-dust (formed in the boring of her tunnel) glued together, and also to the sides of the cylinder, an annular stage. When this is sufficiently hardened, its anterior edge affords a support for a second ring of the same materials; and thus the ceiling is gradually formed of these concentric circles, until a small orifice in the centre only remains; and this is also filled up with a circular mass of the agglutinated saw-dust. This partition exhibits the appearance of as many concentric circles as the animal has joinings; and is about the thickness of a French crown-piece. It serves for the ceiling of the lower, and floor of the upper apartment. One cell being completed, she proceeds to another, which she furnishes in the same manner; and so on, till she has divided her whole tunnel into apartments, which are usually about twelve. When the larva assumes the pupa, it is placed in its cell, with its head downwards, and is thus prevented, when it has attained its perfect state, and is eager to emerge into day, from disturbing the tenants of the upper cells, who, being of later date each than its superincumbent neighbour, are not quite so perfected as to be ready to go forth upon the world."

GENUS DCLI. CERATINA. Latr. Jurine, Spinola. 651. C tina.
APIS. Villers, Rossi, Kirby. (** *d.* 2. *a*).
MEGILLA. Fabr. Illiger.
PROSOPIS. Fabr.
PITHITIS. Klug.
CLAVICERA. Walckenaer.

Labrum almost quadrate, perpendicular, entire. Antennæ gradually thickening towards their extremities; the scapus not large.

Cœrule *Sp.* 1. *Cœrulea.*
Apis cœrulea. Villers.

Apis cyanea. Kirby.
Inhabits Europe.

Subdivision 2.

Labrum longer than broad, inclined perpendicularly; porrect beneath the mandibles, elongate, quadrate. Mandibles strong; porrected, with the apex bidentate, in some; trigonate, and often multidentate, in others.

* Labial palpi with the three first joints continuous, the fourth inserted under the external apex of the third.

652. Ro-phites.

GENUS DCLII. ROPHITES. Spinola, Latr.

Mandibles triangular. Maxillary palpi six-jointed.

Quinque-spinosa.

Sp. 1. *Quinquespinosa.*
Rophites quinquespinosa. Spinola, Latr.

653. Che-lostoma.

GENUS DCLIII. CHELOSTOMA. Latr.
APIS. Linn. Villers, Kirby. (** *c.* 2. γ).
HYLÆUS. Fabr.
ANTHOPHORA. Illiger, Fabr.
ANTHIDIUM. Panzer.
TRACHUSA. Jurine.

Mandibles (of the females) arcuated, their apex bidentate or furcate, porrect, internally hairy. Maxillary palpi three-jointed.

The bodies of the insects composing this genus are very long, slender, and cylindric. The belly of the male, near the anus, is concave, and covered with down; and at its base is a horn or protuberance. When asleep, they roll themselves up like an armadillo, the horn or protuberance fitting into the anal cavity. They nidificate in posts and rails. The males usually repose in the centre of a flower.

lorisom-nis.

Sp. 1. *Florisomnis.*
Hylæus florisomnis. Fabr. Panzer.
Apis florisomnis. Linn.
Chelostoma florisomnis. Latr.
Inhabits Europe. The female is *Apis maxillosa* of Linné and Kirby; *Hylæus maxillosus* of Fabricius.

** Labial palpi with the third joint inserted obliquely on the external side of the second, near to the apex.

4. Heria-

GENUS DCLIV. HERIADES. Spinola, Latr.
APIS. Linn. Kirby. (** *c.* 2. γ).
ANTHOPHORA. Fabr. Illiger, Klug.
ANTHIDIUM. Panzer.
TRACHUSA. Jurine.

Labial palpi with the second joint longer than the first. Body very long, cylindric.

This genus, in habit and in economy, resembles *Chelostoma*; the males are often taken asleep in flowers; their abdomen is then doubled, so that the tubercle with which its base is armed fits into the cavity near the anus.

nco-m.

Sp. 1. *Truncorum.*
Heriades truncorum. Spinola, Latr.
Anthophora truncorum. Fabr. Illiger.
Inhabits Europe.

Ste-

GENUS DCLV. STELIS. Panzer.
APIS. Kirby. (** *c.* 1. β).
ANTHOPHORA. Illiger.
MEGACHILE. Latr. Walck.
TRACHUSA. Jurine.
GYRODROMA. Klug.

Labial palpi with the second joint not longer than the first. Maxillary palpi two-jointed; the first joint longest. Mandibles strong. Abdomen convex above, smooth below, and scarcely hirsate.

rrima.

Sp. 1. *Aterrima.*
Stelis aterrima. Panzer, Latreille.
Inhabits Europe.

656. Anthidium.

GENUS DCLVI. ANTHIDIUM. Fabr. Panzer, Klug. Latreille.
APIS. Linn. Geoff. Schæffer, Kirby. (** *c.* 2. β.)
ANTHOPHORA. Illiger.
MEGACHILE. Walckenaer, Spinola.
TRACHUSA. Jurine.

Labial palpi with their second joint not longer than the first. Maxillary palpi one-jointed. Abdomen of the females, below, very hairy; above, convex, incurved; the base broadly truncate. Mandibles broad, multidentate.

The anus of the males of this genus is always armed with spines.

Manicatum.

Sp. 1. *Manicatum.*
Anthidium manicatum. Panzer, Latreille.
Apis manicata. Kirby, Linn.
Inhabits Europe.

The following interesting account of the economy of *Anthidium manicatum*, is extracted from Kirby's *Monographia*. "Linnæus," says he, "observes, upon this bee, *in arboribus cavis nidos construit*; but he takes no notice of the materials of which the nidi were made. This deficiency has been supplied by Mr James Trimmer and Sir Thomas Cullum. The former of these gentlemen some time since informed me, that having had frequent opportunities of watching the motions of *Anthidium manicatum*, and finding that the female constantly attended *stachys germanica*, *agrostemma coronaria*, and other woolly leaved plants which grew in his garden, he was curious to know the reason of this preference. It was not long before his curiosity was gratified; and he discovered that it was the wool which covers the surface of the leaves of these plants, that was their attraction; for he observed the little animal, with her strong "mandibulæ," scraping it off with great industry and perseverance; and while these were thus employed, rolling it up, with her fore legs, into a little ball; making, all the time, a considerable hum. The use to which she applied the material thus collected, Mr Trimmer could never discover; we only conjectured that she employed it in the construction of her nest. Our conjecture is almost turned into certainty by the following account given by my ingenious friend Sir Thomas Cullum, to Mr Marsham, of a nest which he found made of similar materials. He thus expresses himself, in a letter to that gentleman. "I observed, in a lock of one of my garden gates, that the key did not turn easily round; and upon looking into the keyhole, I saw something white. I had the lock taken off, and it was completely full of a downy substance, containing the pupa of some bee, I conclude. Upon examining the downy substance, I am certain it is the fine pappus or down from the *Anemone sylvestris*, of which I had two plants in my garden. I have preserved the whole as I found it; but the bee has not yet made its appearance in its perfect state. I shall watch their progress, and send them to you or to Mr Kirby." This letter is dated October 10. 1800. Sir Thomas has since had the goodness to send me the nidus; the pupæ are still quiescent, (April 2. 1801), and will probably be not disclosed till after Midsummer. Upon comparing it with the anecdote which I have just related of this bee, I cannot help being of opinion, that it is the nidus of that species. It is with some hesitation that I venture to differ from so accurate an observer as Sir Thomas Cullum; but it appears to me that the wool which envelopes the nest and the cells, is scraped from the leaves of one of the first mentioned plants. I gather-

Metabolia. ed some leaves of *Agrostemma coronaria*, and with my penknife shaved off some of its down; and upon comparing it with that used in the nest, under a magnifier, I found that they were exactly the same. This, in conjunction with Mr Trimmer's account, persuades me that the material employed in this instance is not the pappus of *Anemone sylvestris*, which is of a more silky texture. There were several cells or cases included in the lock unconnected with each other, except by the wool which was their common covering. These cases were of an oval form, and consisted of an exterior coat of wool; under this was a membranaceous cell of a pale colour, which was covered with a number of vermiform masses of a brown substance, seemingly made of pollen and honey, in shape and size much resembling *Sphæria canaliculata*, and like that fungus distinguished by a longitudinal furrow slightly impressed. These were laid, without any regular order, over the cell, and by means of them the wool, which formed its exterior coat, was made to adhere. It is remarkable that this bee should employ these materials to cover its cells, which others use only as food for their larvæ. At the summit of this membranaceous case is a small chimney, with an orifice; and within it contains another cell, which is rather coriaceous, strong, and of a brown colour, in the inside shining very much, as if covered with tinfoil. This may be the folliculus or coccoon made by the larva, previous to its assuming the pupa. I opened one of these in the autumn, and another in the spring. In both, the animal was still in its larva state, but had no food remaining in its cell. In that opened in the spring, it appeared to be dead. I imagine, when Sir Thomas Cullum first took them, that they were just ready for their first change; but that the alteration produced by removing the nest from the situation the parent insect had chosen for it, was fatal to some, if not all, of its inhabitants. Amongst the wool were masses of sweet pollen paste." He afterwards adds an extract from the Rev. Gilbert White's *Naturalist's Calendar*, (p. 109.) "There is a sort of wild bee frequenting the garden campion for the sake of its tomentum, which probably it turns to some purpose in the business of nidification. It is very pleasant to see with what address it strips off the pubes, running from the top to the bottom of a branch, and shaving it bare with all the dexterity of a hoop-shaver. When it has got a bundle almost as large as itself, it flies away, holding it secure between its chin and its fore legs."

657. Osmia. Genus DCLVII. Osmia. Panzer, Spinola, Latr.
Apis. Linn. Villers, Kirby. (** *c.* 2. δ.)
Anthophora. Fabricius, Illiger, Klug.
Megachile, Walckenaer.
Trachusa. Jurine.
Hoplitis. Klug.
Amblys. Klug.

Labial palpi with the second joint not longer than the first. Maxillary palpi four-jointed. Abdomen convex above, hairy beneath in the females. Mandibles broad.

Cornuta. *Sp.* 1. *Cornuta.*
Osmia cornuta. Latreille.
Osmia bicornis. Panzer?
Apis bicornis. Kirby?
Inhabits Europe.

This species selects the hollows of large stones for the purpose of nidificating.

Cœrulescens. *Sp.* 2. *Cœrulescens.*
Apis cœrulescens. Kirby, Linn.
Apis ænea. Linn.

Inhabits Europe, constructing its nest of argillaceous earth mixed with chalk, upon stone walls. Mr Kirby supposes that it nidificates also in chalk pits. Metabolia.

Genus DCLVIII. Megachile. Latr. Walck. Spin. 658. Megachile.
Apis. Linn. Villers, Kirby. (** *c.* 2. *a.*)
Anthophora. Fabr. Illiger, Panzer, Klug.
Trachusa. Jurine.
Xylocopa. Fabricius.
Centris. Fabricius.

Labial palpi with the second joint not longer than the first. Maxillary palpi two-jointed, the first rather longest. Mandibles very strong. Abdomen triangular, flat above, very downy beneath in the females.

The insects of this genus are well known by the name of *Leaf-cutters*, *Carpenter-bees*, and *Coupeuses de feuilles*; their interesting economy having attracted the attention of many naturalists. So early as 1670, it was noticed by Ray, Dr Lister, Willoughby, and Sir Edward King. Linnæus in this, as in many other instances, (supposing the economy of a genus to be peculiar to one species only,) has confounded several species under the general title of *Apis centuncularis*, and denoted it by the orange-coloured hairs which cover the under side of the abdomen, a character which it possesses along with a great number of species.

Some of the species nidificate in trees, and others beneath the ground. The following history of the economy of the genus, (and which will apply to all with which we are acquainted,) is given by Reaumur. "The nests they construct are cylindrical, sometimes six inches in length, and composed entirely of the leaves of trees. They usually consist of several cells, each of which is shaped like a thimble, the convex end of the second fitting closely into the open end of the first, the third into the second, and so on with respect to the rest. Although these cells are honey-tight, which is often found within them in a liquid state, yet the portions of the leaves are not glued together, but merely most accurately adjusted to each other. In forming the cell, the pieces of leaf are made to lap over one another, so that the natural margin of the leaf is kept on the outside, and that which has been cut within; thus a tube is first formed, and in this way coated with three or four layers, the exterior covering being made of larger pieces than the interior. In coating, the provident insect is very careful to lay the middle of each leaf over the margins of those that form the first tube; thus the sutures are covered and strengthened. At the closed end, or narrow extremity of the cell, the leaves have a bend given to them, so as to form a convex termination; when a cell is formed in this manner, her next care is to fill it with pollen and honey. When it is nearly filled, she deposits an egg, and closes it with three pieces of leaf," (sometimes with more,) "which are so exactly circular, that a pair of compasses could not define their margin more truly; and these coincide most accurately with the sides of the cell, and are retained in their situation by no gluten, but by the accuracy of their adaptation alone. After this covering is fitted in, there remains still a concavity which receives the convex end of the succeeding cell. In this manner, the patient and indefatigable little animal proceeds, till she has completed her cylinder of six or seven cells. This cylinder is coated externally by other pieces of leaf of larger dimensions than those used in making the cells, and of a different form, for they are nearly oval; those at the ends are bent inwards, to cover each extremity. These nests are usually made in fistular passages, which these indefatigable creatures bore under ground in a horizontal direction;

olia. their diamater is exactly that of the cylinder, to which indeed, they give its form, and their bend to the pieces which compose it. If by any accident their labour is interrupted, or their edifice deranged, it is astonishing with what persevering patience they set themselves to put all things again in order. Their mode of cutting the leaf, too, requires particular notice. Nothing can be more expeditious; they are not longer about it than we should be with scissars. When the insect has selected a bush furnishing the leaves required, she keeps hovering over and flying round it, until she has discovered the leaf best adapted for her purpose. When she has chosen the leaf, she alights on it, sometimes on the upper surface, sometimes underneath it, or at other times on its edge, so that the margin passes between her legs. As soon as she has made a beginning; (which she usually does near the main nerve,) she continues cutting with her mandibles, until the work be completed. As she proceeds, she keeps the margin of the detached part between her legs, those on one side being above, and the other below it, so that the section keeps yielding to her, and does not interrupt her progress. She makes her incision in a curve line, approaching the rachis at first; but when she has reached a certain point, she keeps receding from it towards the margin, still cutting in a curve. When she has nearly detached the portion she has been employed upon from the leaf, she balances herself, lest its weight should carry her to the ground; and the moment of its parting from the parent stock, she flies off, the detached portion remaining bent between her legs, and being perpendicular to her body. She pursues the same mode, whatever the form or size of the piece necessary for her purpose. The larvæ when arrived at full size, spin a cocoon thick and solid of silk, which they attach to the sides of the cell."

Mr Kirby very justly supposes Reaumur to be mistaken with respect to the mode of forming their cylindric nests. He considers that the nest takes its form, and the leaves composing it their bend from the passage, and that the external coat must be first deposited, as the insect could not get between the side of the cylinder and of the nest.

ecu- *Sp.* 1. *Centuncularis.*

Apis centuncularis. Linnæus, Fourcroy, Kirby.

Megachile centuncularis. Latreille.

Inhabits Europe. Builds its cells with the leaves of roses, and of the *Mercurialis annua.*

æ- Genus DCLIX. Cælioxys. Latreille.

rs. Apis. Linn. Villers, Kirby. (** *c.* 1. *a.*)

Anthophora. Fabricius, Illiger, Klug.

Megachile. Walckenaer.

Trachusa. Jurine.

Anthidium. Panzer.

Heriades. Spinola.

Labial palpi with their second joint not longer than the first. Maxillary palpi two-jointed, the first double the length of the second. Mandibles narrow and strong in both sexes. Scutellum spiny. Abdomen conic or triangular, very little or not at all downy. Anus of the males spiny.

a. *Sp.* 1. *Conica.*

Apis conica. Kirby.

Cælioxys conica. Latreille.

Male.

Apis quadridentata. Linn.

Anthophora quadridentata. Fabr.

Female.

Apis conica. Linn.

Inhabits Europe.

Metabolia.

Subdivision 3.

Labrum remarkably longer than broad, inclining perpendicularly to the mandibles, triangulate, truncate. Mandibles narrow, pointed, unidentate on their internal edge. Body simply pubescent. Superior wings with two submarginal cells complete.

Genus DCLX. Ammobates. Latreille. 660. Ammobates.

Maxillary palpi six-jointed. Superior wings with two submarginal cells.

Sp. 1. *Rufiventris.* Rufiventris.

Ammobates rufiventris. Latreille.

Inhabits Portugal.

Genus DCLXI. Phileremus. Latreille. 661. Phileremus.

Epeolus. Fabricius.

Maxillary palpi two-jointed. Superior wings with two submarginal cells.

Sp. 1. *Punctatus.* Punctatus.

Epeolus punctatus. Fabricius.

Phileremus Kirbyanus. Latreille.

Obs. Latreille has a divison of this genus, in which the superior wings have but one submarginal cell, which character is certainly sufficient to constitute a distinct genus.

Subdivision 4.

Labrum a little broader than long, subsemicircular or semioval. Mandibles slender, pointed, unidentate on their internal edge. Abdomen not pollenigerous.

* Lip with the lateral divisions shorter than the palpi. Body simply pubescent.

Genus DCLXII. Nomada. Scop. Fabr. Illiger, Klug. Spinola, Jurine, Panzer. 662. Nomada.

Apis. Linn. Villers, Kirby, (* *b.*)

Superior wings with three submarginal cells complete. Maxillary palpi six-jointed.

The history, economy, and mode of nidification of the insects of this genus (all of whom are remarkable for the gaiety of their colours) as yet remain a secret. Dr Leach has strong reasons for suspecting them to be parasitical, and this seems the more probable from their having no instruments for carrying pollen. Their flight is silent, unattended by any hum; they frequent dry banks. Their eyes, whilst living, exhibit through the external reticulated covering, a surface of hexagons, which keeps shifting with the light.

Sp. 1. *Ruficornis.* Ruficornis.

Apis ruficornis. Linn. Kirby.

Nomada ruficornis. Fabr. Latr.

Inhabits Europe.

Genus DCLXIII. Epeolus. Latreille, Fabricius, Illiger, Jurine, Panzer, Spinola, Klug. 663. Epeolus.

Apis. Linné, Kirby, (** *b.*)

Superior wings with three complete submarginal cells. Maxillary palpi one-jointed.

Sp. 1. *Variegatus.* Variegatus.

Epeolus variegatus. Fabricius, Panzer, Latreille.

Apis variegata. Linné.

Inhabits Europe, but is very local, (if not rare,) in Britain.

Genus DCLXIV.* Pasites. Jurine, Spinola. 664. Pasites.

Biastes, Panzer.

Nomada. Fabricius.

Anthophora. Illiger.

Superior wings with two complete submarginal cells. Maxillary palpi four-jointed.

Sp. 1. *Schottii.* Schottii.

Biastes schottii. Panzer.

Nomada schottii. Fabricius.

Pasites schottii. Latreille.
Inhabits Europe.

** Lateral divisions of the lip almost as long as the palpi. Body very villose in parts. Scutellum spinose. Superior wings with three submarginal cells.

665. Oxæa. **Genus DCLXV.** Oxæa. Klug. Latreille.
Maxillary palpi one-jointed, very short.
Flavescens. *Sp.* 1. *Flavescens.*
Oxæa flavescens. Klug. Latreille.

666. Crocisa. **Genus DCLXVI.** Crocisa. Jurine, Latreille.
Thyreus. Panzer.
Melecta. Fabricius, Illiger, Klug.
Nomada. Rossi.
Maxillary palpi three-jointed.
Histrio. *Sp.* 1. *Histrio.*
Melecta histrio. Fabricius.
Melecta histrionica. Illiger.
Crocisa histrio. Latreille.
Inhabits Europe.

667. Melecta. **Genus DCLXVII.** Melecta. Latreille, Panzer, Fabricius, Illiger, Spinola.
Apis. Linn. Kirby, (** *a.*)
Crocisa, Jurine.
Symmorpha. Klug.
Maxillary palpi six-jointed, with five very distinct.
The insects of this genus are supposed to be parisitical.
Punctata. *Sp.* 1. *Punctata.*
Melecta punctata. Latreille.
Crocisa atra. Jurine.
Apis punctata. Kirby.
Inhabits Europe. Is common near Swansea in South Wales.

Family II. *Apida.*

Lip with the apex generally hirsute, not inflected.

Division I.

Hinder feet of the females, with their tibiæ externally, and the first joint of the tarsi very hairy.

Subdivision 1.

Maxillary palpi with more than four joints. Lip with its lateral divisions as long or longer than the labial palpi. Antennæ of the males very long.

668. Eucera. **Genus DCLXVIII.** Eucera. Scopoli, Fabricius, Latreille, Panzer, Spinola, Klug.
Apis. Linn. Kirby, (** *d.* 1.)
Maxillary palpi distinctly six-jointed. Superior wings with two submarginal cells, complete.
Longicornis. *Sp.* 1. *Longicornis.*
Eucera longicornis. Fabricius, Panzer, Latreille.
Apis longicornis. Kirby, Linn.
Inhabits Europe.

669. Macrocera. **Genus DCLXIX.** Macrocera. Latreille.
Eucera. Panzer.
Maxillary palpi distinctly five-jointed, the sixth joint very obsolete, or wanting. Superior wings with three submarginal cells complete.
Antenuata. *Sp.* 1. *Antenuata.*
Eucera antenuata. Panzer.
Macrocera antenuata. Latr.
Inhabits Europe.

Subdivision 2.

Maxillary palpi with four joints or more. Lip with the lateral divisions shorter than the palpi. Superior wings with three submarginal cells complete.

* Labial and Maxillary palpi alike.

670. Me-litturga. **Genus DCLXX.** Melitturga. Latreille.
Maxillary palpi six-jointed. Labial palpi filiform.
Clavicornis. *Sp.* 1. *Clavicornis.*
Melitturga clavicornis. Latreille.
Inhabits France.

** Labial palpi setiform.

671. Anthophora. **Genus DCLXXI.** Anthophora. Latr. Spinola.
Lasius. Jurine.
Apis. Linn. Geoff. Kirby, (** *d.* 2. *a.*)
Podalirius. Walckenaer.
Centris. Fabricius, Panzer.
Megilla. Illiger, Klug. Fabricius.
Mandibles unidentated within. Maxillary palpi six-jointed.
Retusa. *Sp.* 1. *Retusa.*
Apis retusa. Linn. Kirby.
Lasis pilipes. Jurine.
Megilla pilipes. Fabricius.
Anthophora hirsuta. Latreille.
Inhabits Europe.

672. Saropoda. **Genus DCLXXII.** Saropoda. Latreille.
Megilla. Illiger, Panzer.
Heliophila. Klug.
Apis. Kirby.
Mandibles unidentate within. Maxillary palpi five-jointed.
Rotundat *Sp.* 1. *Rotundata.*
Megilla rotundata. Panzer.
Saropoda rotundata. Latreille.
Inhabits Europe.

673. Ce tris. **Genus DCLXXIII.** Centris. Fabricius.
Apis. Linn.
Megilla. Illiger.
Lasius. Jurine.
Trachusa. Klug.
Hemisia. Klug.
Mandibles quadridentate. Maxillary palpi four-jointed.
Hæmor-rhoidalis. *Sp.* 1. *Hæmorrhoidalis.*
Centris hæmorrhoidalis. Fabr. Latr.
Inhabits Europe.

Subdivision 3.

Maxillary palpi one-jointed.

674. E charis. **Genus DCLXXIV.** Epicharis. Klug. Illig. Latr.
Apis. Olivier.
Centris. Fabricius.
Xylocopa. Fabricius.
Bombus. Illiger.
Acanthopus. Klug.
Superior wings with three submarginal cells.
Dasyp *Sp.* 1. *Dasypus.*
Epicharis dasypus. Klug. Illiger, Latreille.

Division II.

Hinder feet with the tibiæ and first joint of the tarsi shortly hairy.

(Social bees.)

Subdivision 1.

Hinder tibiæ terminated by two spurs or heels. Superior wings with three submarginal cells in all, complete, the last neither linear nor oblique.

675. E glossa. **Genus DCLXXV.** Euglossa. Latreille, Fabricius, Illiger, Klug.
Centris. Fabricius.
Bremus. Jurine.
Apis. Linn.
Labrum almost perfectly quadrate. Promuscis as long as the body. Ocelli disposed in a triangle.

Sp. 1. *Dentata.*
Euglossa dentata. Fabr. Latr.

Dentata.

Sp. 2. *Dimidiata.*

Dimidiata.

Centris dimidiata. Fabr.
Euglossa dimidiata. Latr.

677. Bombus.

GENUS DCLXXVII. BOMBUS. Latreille, Fabricius, Illiger, Panzer, Spinola, Klug.
APIS. Linn. Kirby, (** *c.* 2.)
BREMUS. Jurine.

Labrum transverse. Promuscis shorter than the body. Ocelli disposed in a transverse, straight line.

The *Bombi* usually nidificate in cavities beneath the ground, but many of the species, (especially those of a fulvescent colour,) construct their nest of moss, on the surface. The females appear early in the spring, when the salices or willows are in bloom. The males are most abundant in the autumn.

Terrestris.

Sp. 1. *Terrestris.*
Bombus terrestris. Fabr. Latr.
Apis terrestris. Linn.
Inhabits Europe.

Muscorum.

Sp. 2. *Muscorum.*
Bombus muscorum. Fabr.
Inhabits Europe.

Subdivision 2.

Hinder tibiæ without spurs or heels. Superior wings with two or three complete submarginal cells, the last oblique or linear.

678. Apis.

GENUS DCLXXVIII. APIS of authors.

Hinder tarsi with their first joint long. Superior wings with three submarginal cells complete, the last oblique and linear.

Melifica.

Sp. 1. *Melifica.* (Hive bee.)
Apis melifica of authors.

The interesting economy of the hive bee has engaged the attention of Swammerdam, Reaumur, Huber, Wildman, &c. to whose works we must refer the reader, as the history of this curious animal would suffice to fill a bulky volume.

679. Melipona.

GENUS DCLXXIX. MELIPONA. Illiger, Klugellan, Latreille.
APIS. Fabr.
TRIGONA. Jurine.

Hinder tarsi with their first joint obtrigonate. Superior wings with two complete submarginal cells. Mandibles without any remarkable process.

Favosa.

Sp. 1. *Favosa.*
Apis favosa. Fabr.
Melipona favosa. Latr.

680. Trigona.

GENUS DCLXXX. TRIGONA. Jurine, Latreille.
MELIPONA. Illiger, Klug.
APIS. Fabricius.
CENTRIS. Fabr.

Amalthea.

Sp. 1. *Amalthea.*
Apis amalthea. Fabr.
Trigona amalthea. Latr.

Spinipes.

Sp. 2. *Spinipes.*
Centris spinipes. Fabr.
Trigona spinipes. Latr.

ORDER DIPTERA.

ORDER DIPTERA. Linn. Latr. &c.
CLASS ANTLIATA. Fabr.

The insects composing this order are distinguished from all other insects by the following characters:

Wings two, naked, unprotected. Haltares, (poisers or balancers,) placed behind, and generally beneath the wings.

Besides these characters, may be noted some others which are common to almost all dipterous insects. The mouth is for the most part furnished with a rostrum having no articulations. Thorax composed of but one segment, always distinct from the abdomen.

The *Diptera* are at this time undergoing investigation by some very eminent entomologists, and as the Editor is desirous of rendering every part of this work as complete as the nature of the publication will admit, he has resolved to defer giving the arrangements of this order, until the article INSECTA goes to press, when the most approved system of *Diptera* will be given; in the mean time, we shall merely give a tabular view of the arrangement of Latreille, the terminations only being altered, and the term *tribe* being used for *family*.

SECTION I. PROBOSCIDEA.

Head distinct from the thorax by an evident interval. Proboscis (rarely wanting) univalve. Tarsi with two simple nails.

DIVISION I.

Antennæ with many joints.

TRIBE I. TIPULARIDES.

DIVISION II.

Antennæ with not more than three joints.

Subdivision 1.

Antennæ with the last joint having at least four rings or amulations.

TRIBE II. STRATIOMYDES.

Haustellum with two setæ.

TRIBE III. TABANIDES.

Haustellum with many setæ.

Subdivision 2.

Antennæ with the last joint having not more than three rings.

A. Haustellum with four setæ at least.

a. Proboscis (when at rest) entirely or partially prominent.

* Proboscis terminated by two large lips.

TRIBE IV. RHAGIONIDES.

Palpi prominent, cylindric-conic. Wings divaricating. Antennæ generally moniliform.

TRIBE V. DOLYCHIPODES.

Palpi prominent, lamelliform. Wings incumbent. Antennæ patelliform.

TRIBE VI. MYDASIDES.

Palpi not prominent.

** Proboscis terminated by very small lips.

TRIBE VII. ASILIDES.

Body long. Wings incumbent. Antennæ three-jointed.

TRIBE VIII. EMPIDES.

Body long. Wings incumbent. Antennæ two-jointed.

Tribe IX. Anthracides.

Body short. Wings divaricating. Antennæ distant, three-jointed. Head as high as the thorax.

Tribe X. Bombylides.

Body short. Wings divaricating. Antennæ contiguous, three-jointed. Head lower than the thorax.

Tribe XI. Acrocerides.

Body short, as if inflated. Wings divaricating. Antennæ three or two-jointed.

b. Proboscis (when at rest) retractile within the cavity of the mouth.

Tribe XII. Syrphides.

B. Haustellum with two setæ.

Tribe XIII. Conopsides.

Proboscis prominent, nearly cylindric or conic, without any remarkable dilatation.

Tribe XIV. Muscides.

Proboscis retractile, terminated by a very remarkable dilatation.

Tribe XV. Œstrides.

Proboscis wanting.

This tribe is considered by Dumeril as forming a distinct division from the tribe Muscides, and in this opinion we most thoroughly concur.

Section II. Eproboscidea.

Head divided from the thorax by a suture at least. Proboscis provided with two valves. Nails of the tarsi double or treble.

For a farther arrangement of the *Diptera*, see Insecta.

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Entre-Douro-e-Minho.

ENTRE-DOURO-E-MINHO, the name of one of the most populous provinces of Portugal, and so called from its situation between the rivers Douro and Minho. It is bounded on the north by Gallicia, a province of Spain; on the east by Trales Montes and Spain; on the south by the Portuguese province of Beira, from which it is separated by the Douro; and on the west by the Atlantic Ocean. It extends from 40° 50′ to 42° of North Latitude, and from 8° 55′ to 7° 55′ of West Longitude. It is about eighteen leagues long, and eleven broad; and the whole province is a collection of granite mountains, the eminences consisting of bare granite sand, and the vallies alone being fertile. As the inhabitants are extremely industrious, the soil is well cultivated, and a system of irrigation is carried on to such an extent, that the numerous wells obtained by digging, give the country an appearance of being covered with shafts of mines. The principal article of produce is maize, though rye, barley, and wheat, are sometimes cultivated. The vine yields a bad wine resembling vinegar, the grapes being shaded from the sun by the tops of trees.

The principal vallies in this province are those of Villanova, of Braga, Ponto de Porto, and of Villar de Veiga.

The valley of Villanova is extremely beautiful. Small fields of maize, and even of rye and barley, and rarely of wheat, are encircled with lofty oaks, chesnuts, and poplars, every tree supporting a vine, which spreads over its summit, and often reaches the top even of the highest oaks. The fields are watered by artificial brooks, which communicate an agreeable freshness to the air even in the heat of summer.

Arid mountains, covered with heath, separate the valley of Villanova from that of Braga. The city of Braga, of which we have already given a full description in that article, is situated in a broad open vale, shaded by trees, and well cultivated, and abounding with cork trees.

The valley of Ponto de Porto, where there is a stone bridge over the Cavado, and a village of the same name, is about a league from Braga. This valley is extremely beautiful, appearing like a thick wood of high trees, though the houses, fields, and gardens, are embosomed among the trees. At the distance of two leagues from that valley, and at the foot of the mountain, stands the rich and extensive Bernardine monastery of Bouro, situated about 500 feet above the level of the sea. On a mountain, at a great distance, is the church of Nossa Senhora de Abbadia, where there is a miraculous figure of the Virgin, which is visited by numerous pilgrims.

Into the valley of Villar de Veiga, which is the name of a large village, the rapid stream of the Rio das Caldas pours itself over rugged rocks; and, after climbing the mountains for about a league, the traveller reaches the village of Caldas de Geres, celebrated for its warm baths. The valley is here extremely narrow. To the eastward, the houses lean against the rocks, a stream waters them to the west, and also the foot of another mountain. The valley to the northward rises rapidly up the heights; and an eminence to the southward, before it descends, incloses this dell. The mountains are steep, lofty, and rocky, trees being found chiefly on the banks of the river, consisting of oaks, berry bearing alders, azereiros, and olives. The mountains are covered with thick bushes, especially along the brooks, and consist of strawberry trees, erica arborea, azereiros, and two new varieties of cytisus, which render the mountains impassable. Single oaks of a remarkable kind, grow on the highest summits.

The village of Caldas de Geres consists of 40 stone houses, which are ill built, and have but one story. The apartments are small and inconvenient, the windows have in general no glass, and the floors are so bad that one can see through them. Their only furniture consists of a rough wooden table and coarse chairs. A small square, about 200 paces in length, serves as the promenade; but there is no place where the company can ride; ladies, and feeble patients, being carried in litters borne by two horses. The warm springs rise to the eastward from a wall of granite rock, at the foot of a high mountain. They are four in number, and over each a square house is built, in the middle of which is a bath walled round. One person only can bathe at a time; and a curtain is the only screen for protecting the bathers from view. One of the springs contains hepatic gas. The heat of the warmest does not exceed 40° of Reaumur; and the hottest may be used as a bath. The bathing season continues from June till August. The company, which consists of the English from Oporto, and of the inhabitants of the small towns of the Minho, rise at four in the morning, bathe or drink the waters immediately, and then walk till near seven. They dine at 12, and then take a long sleep; at four they again bathe or drink the water; after sunset they take a second walk, and, after assembling at a tea or card party, they sup at 10.

Entre-Douro-e-Minho.

The mountains of Serra de Geres, which separate this province from Spain, extend in general from east to west, but send out many arms to the south. The valley where Caldas lies, stretches in the same direction, rising continually to the north, till it again sinks towards the frontiers of Gallicia, which are only three leagues distant from Caldas. The valley rapidly narrows, becomes more woody and rocky, till the traveller enters a thick shade of lofty oaks. Lofty walls of rugged rocks now appear, and the mountain assumes an appearance of sublimity. Near Gallicia, the river Hosnem intersects the valley obliquely, and flows into another. In this place are the ruins of a Roman bridge and a Roman road, which the mountain torrents have in vain endeavoured to destroy. From this spot a narrow footpath leads into Spain, which commences in a pass called Portela de Homem. The highest of the mountains of Geres is to the eastward of Caldas, towards Montalégre; the highest peak, which is between 3000 and 4000 feet high, is named *O Murro de Burrageiro*, and consists of rocks heaped together. The view to the west is extensive, commanding the greater part of the province of Minho and the sea. The horizon in other quarters is bounded by mountains. The granite of which this range of mountains consists, often contains bar-shorl, and, in the clefts, mountain-crystals and smoke topazes, and sometimes a fine rose-coloured quartz. The flora consists of Biscayan and Pyrenean plants, and of several nondescript species. Wolves are here so numerous, as to render this range dangerous for travellers. The Caucasian goat abounds here; it is found in the northern part of the peninsula: its flesh is much esteemed; the skin is used as covers for mules, and the horns for household ornaments. Great numbers of lizards and snakes abound in this range: these are generally the *Lacerta agilis* of Linnæus, and the *Vipera Redi*.

Between Caldas and the village of Covide, appear the remains of an old mountain fort, which the inhabitants affirm are the ruins of an old city called *Chalcedonia*. No inscription occurs among these ruins.

The chief towns of this province are Braga, Oporto, Viana, Amarante, Guimaraens, Ponte de Lima, and Pe-so de Regna. The principal rivers are, the Minho, the Douro, the Lima, the Neiva, the Cavado, the Ave, &c. all of which run westward into the Atlantic.

The province contains three cities, 25 towns, 223,495 houses, and 900,000 inhabitants. (w)

ENYDRA, a genus of plants of the class Syngenesia, and order Polygamia Segregata. See BOTANY, p. 312.

EPACRIS, a genus of plants of the class Pentandria, and order Monogynia. See BOTANY, p. 141, 170.

EPACT. See CHRONOLOGY, vol. vi. p. 411.

EPAMINONDAS, a celebrated Grecian general, was born at Thebes in Bœotia; and was descended, by his father Polymnis, from the ancient sovereigns of his country. He was educated in his father's house, along with Philip of Macedonia, under the Pythagorean philosopher Lysis; and, from an early age, devoted himself to the study of philosophy. Nor was he inattentive to the more ornamental accomplishments; and particularly applied himself to those athletic exercises, which at that time formed the chief amusement of the Grecian youth. While he was distinguished by the most amiable dispositions, and mingled freely with young persons of his own age, he was remarkably reserved in his manners. He spoke seldom, even to his intimate friends; but the few words which he occasionally uttered were so uniformly pertinent and judicious, that, when he was only 15 years of age, it was said of him by Spintarus of Tarentum; "I never knew a man who understood so much, and spoke so little.' Though thus accomplished and admired, he was one of the poorest citizens of Thebes; and no solicitations of his friends could ever prevail upon him to accept of riches, or to alter his frugal mode of life. Anxious to correct the luxurious manners of his countrymen, and to inspire them with that virtuous spirit, which might enable them to maintain their public liberties, he omitted no opportunity of resisting their dissipated habits; and, when once questioned, at a public festival, why he had appeared in so plain a dress, and with so pensive an aspect, he sarcastically replied, "because I wish, that one person may remain to watch over the safety of the city, when you are all drowned in wine and debauchery." Having attracted the esteem and affection of Pelopidas, one of the wealthiest and most illustrious of the Thebans, he inspired his friend with similar sentiments; and, by their united influence and example, they revived among their fellow citizens that love of sobriety and virtue, which laid the firm foundation of their future eminence. These two friends, having been appointed to join the troops, which were sent to the assistance of the Lacedemonians, in the war against the Arcadians, gave the first signal proof of their own military spirit, and raised the character of their country among the neighbouring states. At the battle of Mantinea, they sustained with heroic courage the hottest of the fight, and Pelopidas, having fallen covered with wounds upon heaps of slain, the desperate exertions of Epaminondas for his rescue, restored the victory to the routed Lacedemonians. When the Spartans, a few years afterwards, jealous of the rising power of the Thebans, had treacherously made themselves masters of their city, and when Pelopidas, with the other exiles, had formed a scheme for the liberation of their country, Epaminondas, whose obscure station and love of study had saved him from banishment, privately seconded the enterprize with the utmost sagacity, and after the execution of the plot, openly appeared among the assertors of the independence of Thebes. Sacrificing his love of retirement and philosophy to the interests of his country, he came forward with his friend to share all the burdens of government, and the dangers of war. By their prudence, vigilance, and activity, they baffled all the exertions of the renowned Agesilaus in several campaigns; prevented him from gaining any other advantage than that of laying waste their country; and gradually taught the Theban soldiers to face, and even to vanquish, on equal terms, their hitherto triumphant invaders. Artaxerxes Mnemon, the Persian monarch, having convoked an assembly of the Grecian states at Sparta, for the purpose of accomplishing a general pacification, Epaminondas was placed at the head of the Theban deputation. Here, while the other deputies were overawed by the haughty Agesilaus, he alone asserted the independence of his country, and recommended a general resistance to the overgrown power of the Lacedemonians. The Spartan king excluded the Thebans from the league, and war was declared against them as the enemies of Greece. Epaminondas was unanimously chosen to conduct the affairs of Thebes; and, having selected six of the principal citizens as his associates, to whom he gave the appellation of Beotarchs, or governors of Bœotia, he marched with 6000 infantry and a small body of cavalry, to oppose the Lacedemonian king, Cleombrotus, at the head of 10,000 foot and 1000 horse. The hostile armies met at Leuctra, a small town in Bœotia, B. C. 371. Epaminondas, by the courage with which he inspired his troops, and the new plan of attack which he adopted, gained a complete victory over double his numbers; and cut off the Spartan commander with the flower of his army. The victorious chief rejoiced in the exaltation of his country; but declared that his highest personal gratification consisted in having acquired so great glory while his parents were alive. Two years after this memorable success, he entered the territories of the Lacedemonians, where, for the space of 600 years, an enemy's camp had never been pitched; and, at the head of 70,000 troops from different states, overran all Laconia with fire and sword; advanced to the very walls of Sparta, which on one occasion he had it in his power to destroy; laid waste its suburbs in the sight of its kings, and, having completely humbled that formidable power in the sight of all Greece, returned to Thebes with an army crowned with victory, and loaded with the spoils of the enemy. Entering his native city, which he had raised from the lowest humiliation to the height of political greatness, he found a factious party prepared to accuse him and his colleague of treason against the state, for having retained their office as Beotarchs four months beyond the term prescribed by law. An assembly of the ungrateful people was ready to condemn the two friends to capital punishment, when Epaminondas, anxious to save the life of Pelopidas, acknowledged the breach of the law which he had committed, and took upon himself the whole of the guilt in having advised the measure; "The law condemns me," he exclaimed before his judges, "and I consent, if it must be so, to suffer as an example; but permit me to make this single request. I suffer for having led you into Laconia, where no enemy before you had dared to penetrate; I suffer for having carried into their towns and territories, the desolations which they first brought upon our miserable country; I suffer for gaining your victories and enlarging your power. Behold the crimes for which I am condemned! let them be engraved upon my tomb, that, when posterity shall hear of my punishment, they may also be informed of the cause." This speech was received with shouts of applause, and the judge pronounced a sentence of acquittal. Epaminondas, stripped of authority, returned without a murmur to the station of a humble citizen; and when, a few years afterwards, an army was sent against Alexander the tyrant of Pheræ, he enrolled himself to serve as a common soldier. In that capacity he saved the army from destruction, and was instantly, by the unanimous voice of the soldiers and citizens, reinstated in the command. During the intervals of peace, he laboured to introduce order and integrity into the management of the public finances; and, in his enlarged views of policy, he adopted the most effectual plans for rendering his country as powerful by sea as it was by land. He persuaded the people to vote a large sum for building a fleet; and succeeded in gaining possession of the maritime stations at Rhodes and Chios. But the growing power of Thebes having excited the jealousy of the other states, he was called to make head against a formidable confederacy of the Mantineans, Athenians, and Lacedemonians. With his usual promptitude in warlike expeditions, he made a sudden attempt upon the city of Sparta; but, after having penetrated to the forum, he was compelled to retreat by the desperate resistance of Agesilaus and his son Archidamus. He then hastened to make a similar attack upon Mantinea; but, contrary to his calculations, found it prepared against a surprise. Anxious to retrieve his own fame, and to raise the courage of his army, which had suffered some depression by the failures of these enterprises, he determined to risk a general engagement. He had an army of 30,000 infantry and 3000 cavalry, while the united forces of the Lacedemonians and of their allies did not exceed 20,000 foot and 2000 horse. But, though superior in numbers, he omitted no advantage which it was possible to derive from military skill; and never exerted his talents more than on this occasion, to deceive and to disconcert the enemy by his manœuvres. His order of battle is considered as the most simple and best concerted, that has been recorded in the annals of ancient tactics. Pretending to pass the Lacedemonians, as if upon a march, he suddenly formed his line of attack, charged their centre with a strong column in an oblique direction, and routed their main body with immense slaughter. To gain a complete victory, he had only to collect his Thebans, and fall upon the wings of the enemy, which were ready to give way; but hurried along by his desire of victory, and his inveteracy against the enemy, he advanced almost alone into the midst of the fugitives. Recovering from their panic, they assailed him with the utmost fury, overwhelmed him with a shower of darts, and one of them at length plunged a lance into his breast, the iron head of which, broken off by the force of the blow, was left in his body. Carried to his tent, he heard without emotion the declaration of the surgeons, that his wound was mortal, and that his death must follow the extraction of the weapon. He first asked his attendants if his buckler had been saved; and when it was brought, he clasped it to his breast as the companion of his exploits. He next inquired concerning the event of the battle; and, having been informed that the Thebans were victorious, he exclaimed, "it is enough; I die unconquered; advise my countrymen to conclude a peace!" One of his intimate friends, lamenting his death, and his want of any offspring to revive his name; "you mistake," he replied, "I leave behind me two immortal daughters, the victory of Leuctra, and that of Mantinea." Having said this, he directed the iron to be extracted, and instantly expired, B. C. 363. The glory of his country perished along with him, and his distinguishing greatness consists in this, that he inspired an obscure and oppressed people with his own exalted sentiments. He has justly been regarded as one of the most distinguished characters that any age or nation has ever produced; and was equally eminent as a philosopher, a statesman, a commander, and a virtuous citizen. See *Corn. Nepos*; Plutarch's *Lives*, Agesil. and Pelop.; *Justin*, b. ix.; Pausanias and Xenophon's *History of Greece*; *Polybius*, b. ix.; *Diod. Sic.* b. xv. and xvi.; *Anacharsis*, vol. ii.; *Univ. Hist.* vols. v. and vi.; and particularly M. de Folard's *Life of Epaminondas*, &c. vol. ii. (q)

EPERUA. See PANZERA, BOTANY *Index*.

EPHEDRA, a genus of plants of the class Diœcia, and order Monadelphia. See BOTANY, p. 339.

EPHEMERA. See ENTOMOLOGY *Index*.

EPHESUS, a celebrated city of Ionia, and once the metropolis of Asia Minor, is affirmed by Pliny, Justin, and Orosius, to have been built by an Amazon, whose name also it is supposed to bear. It was then possessed by the Carians and Leleger; but was occupied by Androclus, the son of Codrus king of Athens, who conducted the first colony of Ionians into Asia. This prince and his immediate descendants continued, during several generations, to exercise the regal power in the new colony; but afterwards, a change, of which the date and the occasion are unknown, took place in the form of government; and the city remained under the administration of a senate, till the time of the tyrant Pythagoras, who usurped the sovereign power, and who flourished before the birth of Cyrus the Great. Under his successor Pindarus, who ruled with an authority equally absolute but with greater moderation, Ephesus was besieged by Crœsus king of Lydia, who, from respect to the tutelary goddess of the place, restored to the citizens their former liberty, and conferred upon them numerous marks of his favour. Pindarus, who, according to Ælian, was the nephew of Crœsus, being obliged to resign his power, retired to Peloponnesus; but the city, which was successively subject to the Persians and to the Grecian states, seems to have again fallen under the dominion of tyrants. Of these, history has mentioned Athenagoras, Comas, Aristarchus, and Hegesias, the last of whom was expelled by Alexander, when he defeated the Persians on the banks of the Granicus, and a democracy established in the city. After his death it passed into the hands of several of his successors, and particularly of Lysimachus, who caused the ancient city to be destroyed, and built a new town in a more commodious situation, and nearer to the temple of Diana, which was about seven stadia from the walls of the former. From this period the Ephesians were subject to the kings of Syria, till the Romans, when they gave liberty to the Greek states in Europe, extended the same privileges to the Greek colonies in Asia. Reinstated in their ancient rights, they became the allies of Rome; but were afterwards persuaded by Mithridates of Pontus to take part with him against their protectors, and even to massacre, without distinction, all the Roman citizens within their gates. For this barbarity they were severely punished by the victorious Sylla, who suffered his soldiers to live upon them at discretion, and almost reduced them to beggary by the heavy contributions which he imposed; but by the favour which they experienced from the future emperors of Rome, they regained, in a great measure, their former splendour, and enjoyed for many years some show of liberty. The city suffered severely from the earthquake, which desolated the principal cities of Asia in the reign of Tiberius; but was completely repaired by that emperor, and ornamented with many magnificent edifices. The games, originally instituted in honour of Diana, appear to have been much attended so late as the reign of Caracalla. It is celebrated as having been the seat of the most flourishing of the first Christian churches, where the apostle Paul preached for three years, where the evangelist John resided during the latter part of his life, and where Timothy was the first bishop. Under the auspices of Constantine and Theodosius, the Christian faith made rapid progress, and numerous churches were erected on the ruins of the Pagan temples. Under the reign of the emperor Alexis, the father of Anna de Comnena, it first fell under the power of the Saracens, from whom it was retaken by the Greeks in 1206, but was again lost in 1283, and from the commencement of the 14th century has formed a part of the Turkish dominions. Long before the extinction of the Greek empire, Ephesus had fallen into general decay; and a new town and citadel having been founded at Aiasoluk or Ajasoluk, about two miles distant, the ancient city was soon totally deserted.

Ephesus was known in ancient times by a variety of names, Alopes, Ortygia, Morges, Smyrna, Trachea, Samornion, and Ptela; and is described by ancient geographers as at once the ornament of Asia, and the most frequented emporium of that continent. Its citizens, in addition to their mercantile eminence, were liberal patrons of the fine arts, and their temples possessed many of the most celebrated productions of ancient genius. Their architecture was conducted principally by Pharax, whom Vitruvius mentions with much commendation. Agasius the son of Dosotheus was one of the most eminent sculptors. Parrhasius, Apelles, and Ephorus, (the master of the latter,) all holding the first rank as painters, were natives of Ephesus. Artemidorus the historian and geographer, and Heraclitus the melancholy philosopher, were also born within its walls. The Ephesians were equally noted for their luxurious and licentious manners; and are said to have banished one Hermodorus solely on account of his virtue. (See Dr Goodwin's Works, vol. i. p. 7.) They were much addicted to superstition, sorcery, and magical arts; whence arose the proverbial expression, "Ephesian letters," to denote those spells or sentences, which they used to write upon their girdles, or to imprint upon different parts of their bodies, as charms against evil, or as sources of supernatural power.

But the great boast of the Ephesians, and the principal ornament of their city, was the celebrated temple of their tutelary goddess Diana. The original object of their worship was a small statue of elm or ebony, made by one Canitias, though commonly believed in those days to have been sent down from heaven by Jupiter; but, what is more remarkable, it had no resemblance to the elegant huntress Diana, and was merely an Egyptian hieroglyphic, with many breasts, representing the goddess of Nature. As the original figure became decayed by extreme age, it was propped by two rods of iron like spits, which, even after its renewal, were religiously adopted in the substitute. It was at first placed upon a block of beach or elm wood, but in later times was preserved in a shrine adorned with all that wealth and genius could contribute. As the veneration for the goddess increased among the inhabitants of Asia, a magnificent temple was constructed on the spot where the elm had stood, and the sacred image placed within it. This temple seems to have been several times (Pliny says seven times, lib. xvi. c. 40.) ruined and rebuilt, a circumstance which may help to reconcile the discrepancies which occur in ancient writers, as to the dates and descriptions of these successive erections. One of them is expressly affirmed by Livy (lib. i. c. 45.) to have been completed in the reign of Servius Tullius, who flourished at the latest 570 years before Christ. Another is described which was originally designed by Ctesiphon, a Cnossian architect, 541 years before the Christian era, whose plan was continued by Demetrius, a priest of Diana, and the whole at length completed by Daphnis of Miletus, and a citizen of Ephesus. This temple is said to have been partially destroyed by fire on the day when Socrates was poisoned, 400 years B. C. and again 356 B. C. by the philosopher Herostratus, on the day when Alexander the Great was born, Diana, says Timæus the historian, being then absent at the delivery of Olympias. The incendiary confessed, upon being put to the torture, that his only motive for the sacrilegious act, was a desire to immortalize his name; and though an assembly of the Ionian states passed a decree condemning his name to oblivion, the prohibition served only the more to perpetuate its remembrance. According to some accounts, nothing but the four walls and a few columns escaped the fury of the flames; while others relate, with greater probability, that only the roof, and some other parts constructed of timber, were destroyed. The Ephesians had begun its reparation, when Alexander, in his expedition against the Persians, offered to appropriate his spoils to the completion of the work, upon condition that his name should be inscribed, as its restorer, upon the front of the edifice. This proposal they accounted it disgraceful for them to accept; but secured the forgiveness of the conqueror by the flattering style in which their refusal was conveyed: "It is not suitable for one divinity," said the Ephesian deputy, "to decorate the temple of another." The women of Ephesus, besides working at the materials intended for its ornament, devoted their jewels to its restoration; and all Asia contributed to its progress. Cheiromocrates, who assisted in building Alexandria, and who had proposed to cut Mount Athos into a statue of Alexander, was the architect employed at its commencement; but 220 years (says Pliny, lib. xxxvi. c. 14.) or even 400 years (says the same author, lib. xvi. c. 40.) were spent in completing the building. It is difficult to determine whether the description of the temple given by this writer applies to its appearance prior or posterior to the conflagration in 356; and it is impossible to make it in any measure intelligible, except by supposing, with the Marquis de Poleni, that its dimensions were exactly the same both before and after the time of Herostratus, and that it was merely restored, though with greater magnificence and taste, to its former state. It was built on a marshy spot, that it might be more secure from the effects of earthquakes; and under its foundations was laid a bed of charcoal firmly rammed, and above that another of wool. The whole building was 425 feet in length, and 220 in breadth, supported by 127 pillars of Parian marble, and of the Ionic order, each 60 feet high. Those pillars were furnished by so many princes, and 36 of them were curiously carved by Scopas, while the rest were finely polished. Along the flanks of the cell was a double row of columns, 15 on each side. It is considered as the first instance in which, according to the Ionic style, the fluted column and capital with volutes were introduced; it is calculated that each pillar, with its capital and base, contained 150 tons of marble. The doors and panneling were made of Cypress wood, polished and shining; and the staircase of vine wood. Its internal decorations were heightened by the lustre of gold, and especially by the most perfect productions of the artists of antiquity. It contained a statue of Hecate, by Scopas; a picture of the goddess Diana, by Timarete, the first female artist upon record; a painting, by Apelles, of Alexander grasping a thunderbolt, purchased for 20 talents of gold. The shrine was adorned by Praxiteles and his son Cephisodorus; and the walls by Parrhasius and Apelles. The priests who served in the temple suffered emasculation, and the sacred virgins were devoted to inviolable chastity. They were eligible only from the higher classes of the citizens, and enjoyed a great revenue with numerous privileges, in addition to the presents received from the crowds of worshippers who flocked to the annual festivals. Their luxurious mode of living, and particularly the cost of their dyed vestments, are described by ancient writers in the most extravagant terms. The Asiarchs mentioned by Luke, (*Acts* xix. 31.) were the principal officers chosen by the community of the Asiatic cities, to preside over the games celebrated at Ephesus in honour of Diana, some of whom might also have been priests of the temple. Among other privileges, the sacred edifice afforded an asylum to those who sought its protection. The inviolable space at first extended one furlong, and was afterwards increased, first by Mithridates, next by Mark Antony, so as to include a part of the city; but, in consequence of the disorders which attended the exercise of such a privilege, it was entirely revoked by Tiberius, who declared, that even the altar itself should not protect a criminal from justice. This celebrated edifice, after suffering various partial demolitions, was finally burnt by the Goths in their third naval invasion, A. D. 260; and travellers are now left to conjecture even as to its scite and its foundations; but the confused heaps of architectural fragments which still remain, sufficiently testify the ancient grandeur of Ephesus. A part of the aqueduct which conveyed water into the city from the spring of Halitæa, still subsists; and the pillars which support the arches are of fine marble; but this structure is generally believed to have been raised by the Greek emperors, out of the ruins of Ephesus. A high wall, at the circular end of the stadium, is perfect, constructed of heavy rough stones; and the gate of the left wing, built of white marble, is nearly entire, but is also made up of fragments of former buildings, and must have owed its origin to a later age. Two vast gateways of a theatre or a Naumachia, and some walls of brick, faced with large marble slabs, supposed to have been either a part of the temple of Diana, or of the church of St John, form the other principal objects of any magnitude. At Aiasoluk or Ajasoluk, once the rival of the parent city, and the residence of the Saraconic princes in the 14th century, is a large portal, formerly leading to the citadel, wholly built with Roman tiles, and faced with polished marble. Over the gateway, and above a very rich frieze, are three pieces of exquisite sculpture, one of which, in alto relievo, represents the bringing of the body of Patroclus to Achilles. For some unknown reason, the Greeks call it the Gate of Persecution, and believe that it represents the martyrdom of Christians. Aiasoluk itself is a miserable village of mud cottages, and about a dozen small square buildings of brick, the ruins of oratories or baths, inhabited by 30 or 40 families of Turkish herdsmen. Its name is considered by some as a Turkish word, signifying the temple of the moon, in reference to the temple of Diana; but is supposed, by others, to be a corruption of Aiaseologos, the modern Greek of Ἁγιος Θεολογος, referring to the residence there of the evangelist John. Even the vale of Ephesus has undergone a total change; and the town could never be supposed, by an observer ignorant of its history, to have had a free communication with the sea. The Cayster, formerly navigable, is now choked with sand, and flows through sedges, which render it almost invisible. Attalus Philadelphus, king of Pergamus, in order to improve the port, which was shallow and incommodious, was persuaded by an architect to construct an extensive mole; but, by the interruption thus given to the current, the earth brought down the river has destroyed the port, and even encroached some miles on the dominion of the sea.

When the city was taken by the Turks in 1300, "the desolation was so complete," says Rycaut, "that the temple of Diana, and the church of Mary, will equally elude the search of the most industrious traveller." See *Ancient Univ. Hist.* vol. vii. p. 416; Anacharsis' *Travels*, vol. vi. p. 188; Vitruvius, l. viii.; Plin. *Nat. Hist.* l. xvi. c. 40, and l. xxxvi. c. 14; Strabo, lib. xiv; Pococke's *Travels*; Sandy's *Travels*; *Voyage Pittoresque de la Grece*, p. 177; Dallaway's *Constantinople*, p. 209, 211. (*q*)

EPHORI. See SPARTA.

EPHIELIS. See BOTANY, p. 199.

EPIBATERIUM. See BOTANY, p. 325.

EPIBLEMA. See BOTANY, p. 317.

EPIC POETRY. See POETRY.

EPICURUS, a celebrated philosopher of ancient Greece, and the founder of that sect which flourished under his name, was born at Gargettus, a village of Attica, in the 109th Olympiad. He was the son of Neocles and Chærestrata, of the illustrious family of the Philaides at Athens. At the age of eighteen, he commenced his philosophical studies in this central seat of learning; during the period when Xenocrates and Aristotle were engaged in exploring the most profound mysteries of science, and extending the circle of human knowledge.

Having acquired an high reputation for natural genius, extensive learning, and patient investigation, when about thirty years of age, he instituted, at Athens, a new philosophical school, and propounded to crowded audiences the peculiar tenets of a system of physical and moral science, which was different, in many essential points, from the doctrines that were taught by the most popular sages of those times. For the grand outlines of his theory of the universe, indeed, he was indebted to the previous labours of Leucippus and Democritus, the most ancient atomic philosophers; but from the sublime conceptions and plastic genius of Epicurus, these broken and discordant features first acquired such a rational form and consistency, as entitled them to the name of a system.

His theory of morals was as much opposed to the rigid maxims of the Stoics, as his life and conversation contrasted with the ascetic habits of the disciples of that celebrated school. In the umbrageous walks of a delightful garden, Epicurus enjoyed the society of his friends, and delivered his instructions to his numerous pupils; whence the institution was denominated *the School of the Garden*, as that of Plato was called the *Academy*, that of Aristotle the *Lyceum*, that of Zeno the *Porch*, and that of Antisthenes the *Cynosargum*.

His manners were easy and affable; his life temperate and virtuous. Having devoted his days to the propagation of science, he died of an inflammation, occasioned by a stone in the bladder, after suffering the most excruciating pain with admirable composure and patience, in the 127th Olympiad, and the seventy-second year of his age.

It is unnecessary for us, in this place, to enter into any discussion respecting the physical principles inculcated by Epicurus, as we have already exhibited a view of his cosmological hypothesis in a former article: (See ATOMICAL PHILOSOPHY.) But whatever objections the combined lights of reason and revelation may have afforded us against the principles of that system, it must still be acknowledged to have been the offspring of a bold, vigorous, and scientific mind; and it is, perhaps, the only rational profane theory, on the subject of cosmogony, which has had sufficient merit to attract respectable disciples in modern times.

The moral principles promulgated by Epicurus have afforded a theme of reprehension to the ascetic philosophers of all ages; and, by a singular misconception of the nature and tendency of his opinions, the very name of that illustrious sage has been converted into an epithet expressive of every thing that is unprincipled, licentious, base, and grovelling, in human conduct and manners. Having assumed, as the basis of his ethical system, the principle, that pleasure is the chief good of man, it has been unwarrantably supposed, that his doctrines give countenance to habitual intemperance, and even recommend the unrestrained gratification of every illicit passion. Nothing, however, can be more unjust than such a representation of the moral theory of Epicurus. His system, indeed, as we have already observed, was directly opposite to that of the Stoical school. He rejected the absurd doctrine of fatality, which constituted the foundation of the philosophy of Zeno, and boldly contended for the free agency of man: a principle, without the admission of which it were vain to attempt to erect any rational system of morality. Disclaiming the external aid of gravity in speech, and of any singular austerity in dress and demeanour, and being himself naturally endowed with an affable and cheerful disposition, he deemed it not necessary for a wise man to be morose, but taught his disciples, on the contrary, to look for pleasure in the pursuit of wisdom, and to consider happiness as the concomitant of virtue. "Wisdom," says Epicurus himself, in his epistle to Menœceus, "is the chief blessing of philosophy, since she gives birth to all other virtues, which unite in teaching us, that no man can live happily who does not live wisely, conscientiously, and justly; nor, on the other hand, can he live wisely, conscientiously, and justly, without living happily; for virtue is inseparable from a life of happiness, and a life of happiness is equally inseparable from virtue." Such principles, whether resulting from correct views of human nature or not, cannot surely be considered as holding out any encouragement to intemperate conduct, or indulgence in illicit pleasures. "Those," says one of his disciples, "whom we call lovers of *pleasure*, are real lovers of *goodness* and *justice;* they are men who practise and cultivate every virtue: for no true pleasure can exist without a good and virtuous life. When we assert, then, that pleasure is the chief good, the prime felicity of man, we do not mean the pleasures of the luxurious and the libidinous, the pleasures of the taste, the touch, or any of the grosser senses, as the ignorant, or those who wilfully mistake our opinions, maliciously assert; but what constitutes pleasure with us, is the possession of a body exempt from pain, and a mind devoid of perturbation," &c. The *summum bonum* of Epicurus, therefore, was nothing else than the *mens sana in corpore sano* of the Roman poet; he proposed to conduct mankind to happiness, not through the deceitful labyrinths of sensual gratification, but along the pleasant paths of knowledge and of virtue.

Among those, indeed, who controverted the doctrines of Epicurus, there were some who ventured to arraign his personal character, and who had recourse even to falsehood and forgery, in order to vilify and degrade him in the opinion of the people. These attempts, it must be confessed, however unjustifiable, have been too successful; as the vulgar prejudices of mankind, from the age of that philosopher down to the present times, sufficiently evince. But the malicious libels, which were industriously circulated, and too readily believed, against the moral character of Epicurus and his disciples, are abundantly refuted by the concurrent testimony of the most respectable authorities,—of men who, although they might dissent from his principles, yet bore witness to the virtuous tenor of his life, and to the purity and excellence of his precepts.

In reality, both the Stoic and the Epicurean professed temperance and virtue, though from opposite principles. According to the former, virtue consisted in a total subjection of the passions, and in the constant and habitual practice of austerity and discipline. The Epicurean, on the other hand, assumed pleasure as the chief good, but, at the same time, sought this pleasure in a proper restraint of the desires and passions, and in the attainment of wisdom, and the exercise of virtue. Pain, according to the Stoic, ought to be considered as an object of indifference, beneath the regard of a wise man; with the Epicurean, on the contrary, it was a great evil, and to be avoided by all means. The theory of the latter sect preserved the influence of the social and moral affections entire; while that of the former evidently tended to produce ascetic apathy and indifference. We shall have no reason, therefore, to quarrel with the ethical system of Epicurus, if its principles be only understood in the same sense in which he seems to have inculcated them. To teach mankind the true road to happiness, has been the professed object of almost every theory of morals; and of all those means by which we can promote our happiness, it will be readily admitted, that there are none more efficacious than the cultivation of temperate and virtuous habits, and the exercise of our intellectual faculties, and benevolent affections.

The doctrines of Epicurus long continued to be favoured by the Romans; and his school was found to flourish under the emperors, after other institutions had begun to decay. The most celebrated adherents to this system were the elder Pliny, Celsus, Lucian, and Diogenes Laertius. The Epicurean theory, however, was not encouraged at Alexandria, which, after the decline of Grecian learning, became the chief seat of literature and science; where the eclectics, who still continued to call themselves Platonists, superseded every other school. In the earlier ages of the Christian church, it fell into utter neglect and obscurity; but, during the 15th century, the doctrines of Epicurus again began to receive some encouragement; and they were subsequently revived in the 17th century, by the writings of Gassendi, Du Rondelle, and others. See Diogenes Laertius X. Gassendi and Rondellius, or Du Rondelle, *de Vit. et Mor. Epicuri.* Des Couturis, *Sur la Morale d'Epicure.* Le Blanc de Guillet's French Translation of *Lucretius*, Paris, 1788, 2 vols. 8vo. Brucker, Cudworth, Bayle, Mason Good's *Lucretius.* (z)

EPICYCLOID, in Geometry, is the curve generated by any point in the plane of a moveable circle, which rolls either on the inside, or the outside of the circumference of a fixed circle. If the circles be both in the same plane, the curve generated will be the *plane* epicycloid.

If again the moveable and fixed circles be in different planes, and the former be the base of a right cone, that rolls on the surface of another right cone, the base of which is the latter, so that the vertices of the cones are at the same point; then, in this case, the curve generated by any point on the plane of the moveable circle is called a *spherical* epicycloid; because the generating point being always at the same distance from the common vertex of the cones, the curve described by it will be on the surface of a sphere.

If a circle roll along a straight line, any point in the plane of the circle will generate a curve, which is called a *cycloid*. The three classes of curves evidently belong to the same family; for if we suppose the cones by which the spherical epicycloid is generated to change to cylinders, by their axes becoming infinitely long; then, the spherical will change to a plane epicycloid: and if again we suppose one of the cylinders to change to a plane, by the radius of its base becoming infinite, the epicycloid will be changed to a cycloid.

Galileo appears to have been the first that noticed particularly the cycloid, about the year 1599. From the elegance of its form, he was led to regard it as a proper figure for the arches of a bridge: he endeavoured to find its area, but did not succeed, on account of the imperfect state of mathematical analysis at that time. It was he that gave the curve the name by which it is now commonly known.

Mersennus, a learned Frenchman, also turned his attention to the cycloid, about the year 1615; but neither was he able to square it. Happening, however, in the year 1628 to become acquainted with Roberval, he proposed the problem of squaring the curve to him; but he also was unable to accomplish it. However, this circumstance led Roberval to study the works of the Greek mathematicians, particularly the writings of Archimedes, and about six years afterwards, when Mersennus again proposed the problem to him, he effected its solution. His success was communicated by Mersennus to Descartes, as a thing of importance, but he did not think there was much merit in the discovery. He was not made acquainted with the demonstration; but in his answer to Mersennus, he sent a sketch of one. Afterwards, when Roberval, mortified by the opinion of Descartes, retaliated by saying, that he had discovered his demonstration by his knowing beforehand what ought to be the result, the latter investigated the method of drawing tangents to the curve, and sent his solution to Mersennus, challenging Roberval, and also Fermat, with whom he then had a dispute, to resolve the same problem. Roberval made various vain attempts, and sent five or six different solutions; and it is even supposed that in the end he availed himself of the true solution of Fermat, which had come into the hands of his friend Mersennus, as Descartes called on him, but in vain, for a demonstration.

Galileo having been informed by Mersennus about the year 1689, that the question of the area of the cycloid was then greatly agitated among the French mathematicians, but, as it appears, without having been made acquainted with what had been found, he requested Cavallerius to attempt its solution. Cavallerius tried it, but did not succeed; however, after the death of Galileo, which happened in 1642, his disciples Torricelli and Viviani, were more successful; the former found the area, and the latter the method of drawing tangents to the curve. The claim of Torricelli to the honour of his discovery was contested by Roberval; but the charge of plagiarism, which he brought against the Italian mathematician, has not been believed by his countryman Montucla, who has discussed the controversy in the second volume of his History of Mathematics, second edition.

The cycloid, the source of so much contention, and on that account compared to the golden apple thrown by Discord among the gods, was again brought into notice by Pascal. This philosopher, not less celebrated for his piety and zeal in defence of the Christian religion, than his mathematical invention, took the cycloid as the subject of his meditation in those sleepless nights which he passed, in consequence of bad health; and he soon extended his discoveries beyond what was then known. He was not of a disposition to boast of his discoveries in geometry; but some of his pious friends supposed that it would be useful to have it known, that the man who had defended religion and Christianity against infidelity, was perhaps the most profound thinker, and the greatest geometer in Europe. They therefore requested that he would try the skill of the mathematicians his cotemporaries, by proposing publicly his problems on the cycloid. He took their advice; and, under the assumed name of *A. Dettonville*, he addressed a circular letter to the geometricians, in 1658, inviting them to resolve his problems, and promising forty pistoles to the author of the first solution, and twenty to that of the next, requiring them also to be sent to Paris by an assigned time. Only two contended for the prize; Lalouére, a French mathematician, and our countryman Dr Wallis. As the former had merely made a partial attempt to resolve the problems, and had failed, his claims were immediately set aside. Dr Wallis, however, had been more successful, yet he had committed some mistakes, and, on this account, the prize was not awarded to him. There were others, who, without aspiring to the prize, sent solutions of one or other of the problems to Pascal. Of this number were, Slusius; the prelate Ricci; the celebrated Huygens; and Sir Christopher Wren, who discovered the rectification of the curve. Pascal published his own solutions in the beginning of the year 1659, in a work entitled *Letters from A. Dettonville to M. de Carcavi*. In the same year, Dr Wallis published a work on the cycloid, and other curves, in which he resolved some of Pascal's problems by his *Arithmetic of Infinites*; and, in the year following, Lalouére also published a treatise on the cycloid; and another work appeared about the same time from the pen of P. Fabri, the jesuit.

The cycloid is remarkable, as well on account of its mechanical as its geometrical properties; and Mr Huygens discovered some of the most interesting of both kinds. To the latter class belongs the property, which we shall demonstrate in this article, by which he shewed how a pendulum may be made to vibrate in an arc of a cycloid; and to the former, the very beautiful property, that all vibrations of a pendulum in arcs of a cycloid, are performed in equal times. See MECHANICS.

The very curious problem proposed by John Bernoulli, viz. "to find the path along which a body may roll from one given point to another, in the shortest time possible, the points being supposed neither in the same vertical nor the same horizontal plane," on account of its elegance, engaged the attention of the most celebrated mathematicians in Europe, who found, that the curve required, or the line of swiftest descent, as it is called, must be a cycloid. See MECHANICS.

Epicycloids appear to have been first invented by Roemer, the Danish astronomer, celebrated for having first discovered the progressive motion of light. He turned his attention to the theory of epicycloids, while at Paris, about the year 1674, not as a speculation purely geometrical, but with a view to improve mechanics, because he found that, by giving to the teeth of wheels the figure of these curves, the action of the moving power on them would be uniform; and that on this account their friction would be diminished.

There are other branches of mechanics connected with the theory of epicycloids. Huygens found that, supposing the force of gravity to act uniformly in the direction of parallel lines, a pendulum moving in a cycloid would perform all its vibrations in equal times, whether it described a greater or a lesser arc. But, by extending the hypothesis, and supposing the force of gravity to be directed to the earth's centre, and to be in all places as the distance from the centre, it became a question what curve a pendulum ought in this case to describe, so as to perform unequal vibrations in equal times? Sir Isaac Newton shewed that the curve ought to be an epicycloid. See *Principia*, lib. i. prop. 51.

The subject of spherical epicycloids was treated by Herman, in the first volume of the Commentaries of the Petersburgh Academy. It appears that a mathematician, named Offenburg, had proposed this problem, "to pierce a spherical roof with oval windows, the perimeter of any one of which may be absolutely rectifiable." Herman believed that he could resolve the problem by spherical epicycloids; having supposed that, in general, they admitted of an algebraic rectification. He had, however, committed a mistake in his reasoning, and thus was led to a wrong conclusion, as was afterwards shewn by John Bernoulli, in a paper on the rectification of these curves, given in the Memoirs of the Academy of Sciences of Paris, 1732, where he shews that the rectification of the curve proposed by Herman requires the quadrature of the hyperbola.

We shall now give a brief view of the properties of cycloids and epicycloids.

I. OF THE CYCLOID.

Definitions.

Of the Cycloid. PLATE CCLIII. Fig. 1.

1. If a circle, EPF, roll along a straight line AB, (Plate CCLIII. Fig. 1.), so that every point of the circumference may touch the line in succession; and if P be that point of the circumference which was in contact with the straight line at the beginning of the motion, when the circle has made a complete revolution, the point P will have described a curve line APDB, which is called a *common cycloid*, also sometimes simply a *cycloid*.

Figs. 2, 3.

2. If, as before, a circle roll along a straight line *a b*, (Fig. 2. and 3.), and Q be that point of its circumference which was in contact with the straight line at the beginning of the motion; and P be a given point in OQ, the radius of the circle, (Fig. 2.), or in the radius produced (Fig. 3.), when the circle has completed a revolution, the point P will have described a curve line APDB, which is called a *prolate* or *inflected cycloid*, if the point P be within the circle (Fig. 2.); and it is called a *curtate cycloid*, if the point is without the circle.

3. In each of the three cycloids, the circle EF is called the *generating circle*.

4. The straight line AB, which joins the points in each cycloid, where the motion of the point that describes the curve begins and ends, is called the *base* of the cycloid.

5. A straight line CD which bisects the base at right angles, and terminates in the curve, is called the *axis*; and the point D, in which it meets the curve, is called the *vertex* of each kind of cycloid.

6. A straight line drawn from any point in the curve, perpendicular to the axis, is called an *ordinate* to the axis; and the segment of the axis between the vertex and an ordinate, is called an *abscissa*.

Corollary to Def. 1. and 2. If the generating circle be supposed to continue to roll along the base produced, in each case the generating point will describe other cycloids, exactly like the first. In fact, they may be considered as forming with it a continuous curve, which never returns into itself, but goes on indefinitely.

PROPOSITION I.

In any cycloid, the base is equal to the circumference of the generating circle.

Plate CCLIII Fig. 1.

In the *common* cycloid APB, (Fig. 1.) every point in the circumference of the generating circle will manifestly touch the base, without sliding along it, while the circle makes a complete revolution: therefore, the base of the cycloid is equal to the circumference of the circle.

Fig. 2

In the *prolate* and *curtate* cycloids, (Fig. 2. and 3.) Q being the point of the circumference of the generating circle, which touches the line *a b* at the beginning and end of the motion; and P being the point in the revolving radius OQ, which generates the cycloid APDB, it is manifest that at the beginning of the motion, the line QP will have the position *a* A, a perpendicular to *a b*; and at the end, it will have the position *b* B, another perpendicular to *a b*; therefore *a* A, *b* B are equal and parallel, and consequently AB is equal to *a b*, which again is manifestly equal to the circumference of the generating circle (Def. 2.).

PROP. II.

In the three kinds of cycloids, the axis is equal to twice the straight line drawn from the point that generates the curve to the centre of the generating circle.

Fig. 1 Fig.

It is evident from the generation of the curves, that as the circle rolls along the base AB of the common cycloid (Fig. 1.) or along the line *a b* of the curtate and prolate cycloids, (Figs. 2. and 3.) which is parallel and equal to the base AB, the centre advances in a straight line parallel to AB; and that the part of the line described by the centre from the beginning of the motion is equal to the arc of the circle that has been applied to AB (Fig. 1.), or to *a b* (Fig. 2. 3.) Therefore, when the circle has completed half a revolution, its centre O will be in CD, the axis, and the point P that generates the curve, will be at D, the vertex; so that the distance between the centre and the vertex is equal to the line OP: but the height of the centre of the circle above the base is the same as it was at the beginning and end of the motion, that is, it is equal to the same line OP; therefore the distance of the vertex from the base is equal to twice OP, that is, to twice the distance between O, the centre of the circle, and the point P that describes the curve.

Cor. A circle described on the axis of the common cycloid, as a diameter, is equal to the generating circle.

Prop. III.

If a circle be described on the axis of a common cycloid as a diameter, and an ordinate be drawn to the axis; the segment of the ordinate between the circle and the cycloid is equal to the arc of the circle between the ordinate and the vertex.

Plate CCLIII. Fig. 4. Let DHC (Fig. 4.) be the circle described on the axis DC as a diameter, and PHG the ordinate; the straight line PH is equal to the circular arc HD.

Let FPE be the position of the generating circle when the point in the circumference that describes the cycloid is at P. The circles CHD, EPF are equal, and the lines HG, PI are manifestly the halves of chords equally distant from the centre; therefore PI, HG are equal, (See Geometry,) and PH=IG=EC. Now the semicircumference CHD, or EPF, is equal to the straight line CA (Prop. 1.), and the arc CH or EP is equal to AE, the part of that line to which it has been applied by the revolution of the circle; therefore the remaining arc HD is equal to EC, that is to PH.

Cor. Let the abscissa DG be denoted by the letter x, and the ordinate PG by y; then, if the radius of the generating circle be expressed by a, and the arc DH by z; the nature of the common cycloid will evidently be expressed by the equations

$$x=a-\cos. z,$$
$$y=z+\sin. z.$$

By exterminating z, and its functions cos. z and sin. z, the relation of x to y will be found, which, however, cannot be expressed in finite terms; therefore the curve is transcendental. The relation of the abscissa and ordinate may, however, be expressed in infinite terms, by a fluxional equation. See Fluxions.

Prop. IV.

If a circle be described on the axis of a prolate or curtate cycloid as a diameter, and any ordinate be drawn to the axis, the arc of the circle between the vertex and the ordinate will be to the segment of the ordinate between the cycloid and circle, as the axis to the diameter of the generating circle.

Fig. 5, 6. Let DHC be a circle described on the axis DC as a diameter, and PG an ordinate meeting the circle in H; and let dc be the diameter of the generating circle; the arc DH is to the straight line PH, as DC to dc.

Let EQF be the position of the generating circle when the point that describes the curve is at P; and let FE, its diameter, which is perpendicular to ab, meet the ordinate in I: draw PO to the centre, and on O, with PO as a radius, describe a semicircle MPN. The semicircles MPN, DHC, being equal (Prop. 2.), and their centres at the same distance from ab, and consequently from AB and PG; the lines PI, HG, which are the halves of chords at equal distances from the centres of equal circles, are equal; also, the arc PN is equal to the arc HC; and the arc PM to the arc HD. Now, the semicircumference EQF of the generating circle being equal to AC, half the base; and the arc EQ equal to the straight line aE, along which it has rolled; that is to AN, a part of the base, the remaining arc QF is equal to NC, the remainder of the base; but because PI=HG, therefore PH=IG=NC; therefore the arc QF is equal to the straight line PH. Now, from similar figures, OP : OQ :: *arc* PM (=*arc* DH) : *arc* QF (=straight line PH), therefore CD : cd :: *arc* DH : PH.

Cor. 1. The arc DH is to the straight line PH as the circumference of the circle DHC to the base AB. For the base is equal to the circumference of the circle FQE.

Cor. 2. Let DG=x, PG=y, arc DH=z; and let a be the radius of the circle described on the axis, and b the radius of the generating circle; then because by the theorem HP=$\frac{b}{a}z$, the nature of the prolate and curtate cycloids will be expressed by the two equations

$$x=a-Cos.\ z,$$
$$y=\frac{b}{a}z+Sin.\ z.$$

Prop. V.

Plate CCLIII. Fig. 7. In the common cycloid, if a circle be described on DC, the axis, as a diameter; and from any point P in the curve, an ordinate PG be drawn to the axis, meeting the circle in H; a tangent PV to the cycloid shall be parallel to HD, the chord of the arc between the vertex and the ordinate.

At the points H, D draw the tangents HR, DR, the latter of which will be parallel to the ordinate PG: draw also another ordinate phg indefinitely near to the former, so that the indefinitely small arcs Pp, Hh may be considered as coinciding with the tangents VP, RH; lastly, draw Pq parallel to Hh, and join Dh meeting PG in m.

Because PH=*arc* DH, and ph=*arc* DHh; therefore ph — PH = *arc* DHh — *arc* DH, that is, pq = Hh; but the triangles hHm, hRD being similar, and hR=RD, therefore hH=Hm; hence pq=Hm, and ph=Pm; the figure Pphm is therefore a parallelogram, and consequently pV is parallel to hD, or to HD.

Prop. VI.

Fig. 7. The arc DP of the common cycloid is double the chord DH of the corresponding arc of the generating circle.

Let the ordinate phg be indefinitely near to PHG; join Dh, meeting PG in m, and draw Hn perpendicular to hm.

Because the arcs Pp, Hh are indefinitely small, as in last proposition, they may be considered as coinciding with tangents to the curves. And because Pp is parallel to DH, or Dh (Prop. 5.) the figure Pphm is a parallelogram; hence Pp=mh; but Hm=Hh, as was shewn in Prop. 5; and therefore nm=nh, and mh=2hn; therefore Pp=2hn. Now Pp and nh are evidently the increments which the cycloidal arc DP and the chord DH receive by the ordinate changing its position from PG to pg; therefore the increment of the arc is always double the increment of the corresponding chord.

Suppose now the arc and chord to be generated by the ordinate moving parallel to itself from the vertex along the axis, then because the arc and chord begin together, and the increment of the one is double that of the other, the arc will always be double the corresponding chord.

Cor. The whole cycloid ADB is four times the diameter of the generating circle, or four times the axis.

Prop. VII.

Fig. 8. If DM be drawn from the vertex of the cycloid parallel to the base, and from any point P in the curve an ordinate PHG be drawn to the axis, meeting the generating circle in H; and PL be drawn perpendicular to DM; the external cycloidal area DLP is equal to

the area contained by the circular arc DH, and the straight lines DG, GH.

Take a point p in the curve, indefinitely near to P; and draw the co-ordinates phg and pl: join DH, and complete the indefinitely narrow parallelograms Gv, Lr. Because the indefinitely little arc Pp may be considered as a straight line, which is parallel to DH, (Prop. V.), the triangles Prp, HGD are similar; hence $rp : Pr :: GD : HG$; that is, $Gg : rP :: PL : GH$; since then the rectangles Gv, Lr have their sides reciprocally proportional, they are equal. (See GEOMETRY). Now the rectangle Gv may be considered as the increment of the circular space DHG; and the rectangle Lr as the increment of the cycloidal space DLP, corresponding to a change in the position of the ordinate from PHG to phg; for as to the triangles hHv, pPr, they vanish in respect of these rectangles: therefore the increments of the spaces DHG, DLP, are equal, and consequently the spaces themselves are equal.

COR. If AM be perpendicular to DM, the whole cycloidal space ADM is equal to the semicircle DHC.

PROP. VIII.

PLATE CCLIII. Fig. 8.

If PHG, an ordinate to the axis, meet the generating circle in H, and the chord HC be drawn to the middle of the base, and PK parallel to HC, meeting the base in K; the space bounded by the cycloidal arc DP and the straight lines PK, KC, CD, shall be triple the corresponding space bound by the circular arc DH, and the straight lines HC, CD.

Draw HN, a tangent to the circle, meeting the base in N; also draw the ordinate phg indefinitely near to PHG, meeting HC in m; join hc; draw pk parallel to hc, and ks parallel to CH or KP. Because the triangles CNH, mhH, are similar, and NC=NH; therefore $hm = h\mathrm{H}$; and because $ph = h\mathrm{H} + \mathrm{arc\ HD} = h\mathrm{H} + \mathrm{PH} = hm + tm$; that is, because $pt + th = 2hm + th$; therefore $pt = 2hm$. And because ks is parallel to cm, and kp to ch, therefore $ps = hm$, and $pt = 2ps$; hence the parallelogram sK is double the triangle pks; and the quadrilateral pkKt is triple the triangle pks, that is hcm. Now the former of these is manifestly the increment of the space PKCD corresponding to a change of position of the chord from CH to Ch, and the latter is the increment of the space HCD; therefore the space PKCD is triple the space HCD.

COR. 1. The cycloidal area DAC is triple the semicircle DHC.

COR. 2. The interior cycloidal space PDG, is the excess of three times the space contained by the arc HD, and the lines HC, CD above the trapezoid PGCK.

PROP. IX.

Fig. 9.

Let AB be the base of a cycloid, ADB and CD its axis: In DC produced take CV=CD; and let a semicycloid, the same as DB, be put in the position AV; and another semicycloid, the same as DA, in the position BV: Suppose now that a thread is fastened at V, and applied along the curve, so as to terminate at A; then, if it be unfolded, beginning at the point A, its extremity P will describe the cycloid ADB.

Draw AR perpendicular to AB, and equal to CD; and describe the semicircle AYR. Let PX, the part of the thread which has been unwrapped from AX, meet AC in T; draw XZ perpendicular to AR, meeting the circle in Y; and PG perpendicular to DC, meeting the circle in H; and join AY, CH.

Because XTP, the part of the thread unfolded, is a tangent to the curve, it is parallel to AY (Prop. 5.); and because it is equal to the arc XA, it is double AY (Prop. 6.), that is double TX; therefore TX= TP; and as, on this account, perpendiculars from X and P on AC will be equal; AZ is equal to CG: Now, the circles AYR, CHD are equal, therefore the arcs AY, CH will be equal, and the chords AY, CH equal and parallel; hence PT is equal and parallel to HC, and PH is equal to CT: But AC being equal to half the circumference CHD, and AT or YX equal to the arc AY (Prop. 3.), that is, to the arc CH; therefore TC, or PH, is equal to the arc DH: Hence the point P is in a cycloid, of which CHD is the generating circle (Prop. 3.), and therefore it is in the cycloid ADB.

NOTE. The property of the cycloid described in this proposition was discovered by Huygens, and applied to the motion of a pendulum. Suppose the line VD to be perpendicular to the horizon, and two thin plates of metal to be bent into the form of semicycloids, and fixed in the positions VA, VB; then, if a pendulum were formed by fixing a weight to the end of a thread PXV, and made to vibrate between the plates, the weight P will, by its motion, describe the cycloid ADB.

This manner of describing a curve by the extremity of a thread which is unfolded from another curve, has given rise to the theory of *involutes* and *evolutes*, one of the most elegant speculations of modern geometry. See FLUXIONS.

For the application of the properties of the cycloid to mechanics, see MECHANICS.

II. OF EPICYCLOIDS.

Definitions.

Of Epicycloids. PLATE CCLIII. Fig. 10, 11.

1. Let AEB be a given fixed circle, and EPF a moveable circle, which rolls either on the outside of the former (as in Fig. 10.), or on the inside (as in Fig. 11.), and in the same plane; also let p be a given point in a line drawn from O, the centre of the moveable circle, through P, a given point in its circumference; and at the beginning of the motion, let P be at A, the point of contact of the two circles, and the point p at a; then, while the circle makes one complete revolution, by rolling along the arc AB, the line Op will revolve about O as a centre, and the point p will describe a line $apdb$, which is called an *epicycloid*.

2. When the generating circle revolves on the outside of the circumference of the fixed circle, the line described is the *exterior* epicycloid; and when the generating circle rolls on the inside of the circumference, the line described is the *interior* epicycloid.

3. The circle EPF is called the *generating circle*, and the point p the *generating point*.

4. A straight line drawn through the centre of the fixed circle, and H, the middle of the base, is called the *axis*; and the point d in which the axis meets the curve, is called the *vertex*.

Corollaries to the Definitions.

COR. 1. The points a and b, the extremities of the epicycloid, are in CA, CB, the radii of the circles drawn to the extremities of the base.

2. The base of the epicycloid is equal to the circumference of the generating circle.

SCHOLIUM. It is evident from the manner of describing the epicycloid, that after the generating circle has made a complete revolution, if it be supposed to continue its motion, a series of epicycloids will be described exactly like the first. Indeed, they may be considered as forming a continuous curve, which will go on continually, if the circumferences of the generating and fixed circles, or their radii, are incommensurable, because, in that case, the two circles will never come twice into contact at the same point. If, however, the radii are commensurable, it is evident that, after a certain number of revolutions of the generating circle, the points P and *p* will come again to the points A and *a*, from which they set out; and thus the curve will return into itself.

If the point that describes the epicycloid be without the generating circle, as at *p*, the curve *a p d b* will be analogous to the curtate cycloid; but if it be within the circle at *p'*, then the curve *a' p' d' b'* will correspond to the prolate cycloid; and lastly, if the generating point be at P, the curve APDB will be more simple, and will correspond to the common cycloid.

Prop. I. *Problem.*

Plate CCLIII. Fig. 12.

To find the equations which express the nature of any epicycloid described on a plane.

Let HEX be the fixed circle, and C its centre; also let F'H be the generating circle when it has made exactly half a revolution. Then its centre O' will be in the axis CH; and the generating point will be at D, the vertex of the curve.

Suppose now that the generating circle has rolled along the arc HE, so that its centre has advanced from O' to O, and the revolving radius from the position O'D to the position OP, while the generating point P has described, by its motion, the epicycloidal arc DP. Draw PK and OG perpendicular to CD, and OM perpendicular to PK, and produce PO to meet the generating circle in L, then L will be the point of the generating circle that was in contact with H, and therefore the arcs LE, HE are equal.

Taking the centre of the fixed circle as the origin of the co-ordinates,

Put CK, the abscissa, ... $=x$,
KP, the ordinate, ... $=y$,
Arc HE$=$arc LE, ... $=z$,
CE, the rad. of fixed circle, ... $=c$,
OE, the rad. of gen. circle, ... $=a$,
OP, the dist. of gen. point from the centre, . $=b$.

Then $\frac{z}{c}$ is the arc of a circle, whose radius is unity, which measures the angle ECH$=$FOM; and, in like manner, $\frac{z}{a}$ is the measure of the angle LOE, or POF; hence $\frac{z}{c}+\frac{z}{a}=\left(\frac{1}{c}+\frac{1}{a}\right)z$ is the measure of the angle POM: Hence

$$\text{CG}=\text{CO}\times\text{Cos. ECH}=(c+a)\text{ Cos. }\frac{z}{c},$$

$$\text{OG}=\text{CO}\times\text{Sin. ECH}=(c+a)\text{ Sin. }\frac{z}{c},$$

$$\text{OM}=\text{PO}\times\text{Cos. POM}=b\text{ Sin.}\left(\frac{1}{c}+\frac{1}{a}\right)z,$$

$$\text{PM}=\text{PO}\times\text{Sin. POM}=b\text{ Cos. }\left(\frac{1}{c}+\frac{1}{a}\right)z;$$

Now $x=\text{CG}+\text{OM}$, and $y=\text{OG}+\text{PM}$; therefore

(A)

$$x=(c+a)\text{ Cos. }\frac{z}{c}+b\text{ Cos. }\left(\frac{1}{c}+\frac{1}{a}\right)z,$$

$$y=(c+a)\text{ Sin. }\frac{z}{c}+b\text{ Sin. }\left(\frac{1}{c}+\frac{1}{a}\right)z.$$

These two equations express generally the nature of all epicycloids, whether *exterior* or *interior*; because, although in investigating them, we have supposed the generating circle to be without the fixed circle. By a well known principle in mathematical analysis, we have only to change the sine of *a* and *b* from + to —, thereby indicating, that the lines which these letters represent, are to be considered as having a contrary direction to that which they had in the former case, and the equations will be adapted to the case of *interior* epicycloids.

In the preceding equations, the co-ordinates are expressed in terms of the arc, which the generating circle has rolled over, reckoned from H, the middle of the base, (Fig. 12.) but it will be convenient to have them also expressed by the arc described from the beginning of the motion. Draw a straight line from C through A, (Fig. 13.) the first point of contact of the two circles, and let us suppose, that the generating circle has rolled along the arc AE, while the generating point, which was at first at A', has described the epicycloidal arc A'P. Let P*c* meet the circle in N, then the arcs EN, EA will be equal. Produce PO, CO to L and F; draw PQ, OR perpendicular to CA; and OT perpendicular to QP. Put the abscissa CQ$=x'$, the ordinate QP$=y'$, the arc AE$=z'$; and, as before, put CE$=c$, OE$=a$, PO$=b$. Then the angle OCR, or FOT, is $\frac{z'}{c}$, radius being unity, and the angle NOE, or FOL$=\frac{z'}{a}$, therefore TOL$=\frac{z'}{c}+\frac{z'}{a}=\left(\frac{1}{c}+\frac{1}{a}\right)z'$.

Plate CCLIII. Fig. 13.

$$\text{Hence CR}=(c+a)\text{ Cos. }\frac{z'}{c},$$

$$\text{OR}=(c+a)\text{ Sin. }\frac{z'}{c},$$

$$\text{TO}=-b\text{ Cos. }\left(\frac{1}{c}+\frac{1}{a}\right)z',$$

$$\text{PT}=b\text{ Sin. }\left(\frac{1}{c}+\frac{1}{a}\right)z';$$

and since $x'=\text{CR}+\text{TO}$, and $y'=\text{OR}-\text{PT}$, we have

(B)

$$x'=(c+a)\text{ Cos.}\frac{z'}{c}-b\text{ Cos.}\left(\frac{1}{c}+\frac{1}{a}\right)z$$

$$y'=(c+a)\text{ Sin.}\frac{z'}{c}-b\text{ Sin. }\left(\frac{1}{c}+\frac{1}{a}\right)z'$$

From this solution we may deduce the following consequences:

1. These two sets of formulæ (A) and (B), enable us to find as many points in any epicycloid as we please, by the help of the trigonometrical tables. To do this, we must give particular values to the angle $\frac{z}{c}$, then we must find from the tables the values of the sines and cosines of $\frac{z}{c}$, and of $\left(\frac{1}{c}+\frac{1}{a}\right)z=\frac{c+a}{a}\,\frac{z}{c}$, and from these, the values of x and y, the co-ordinates of points in the curve may be found; and, in these calculations, regard must be had to the signs of the sines and cosines, as is explained in our article Arithmetic *of Sines*.

2. If *c* and *a* be commensurable, the indeterminate arc *z* may be eleminated from either of the formulæ (A), (B), and thence an equation may be found, which shall express the relation of *x* to *y* in finite terms. For example, if $c : a :: 3 : 2$, so that $\frac{1}{c}+\frac{1}{a}=\frac{5}{2c}$, then, from formula (A),

$$x=(c+a)\text{ Cos. }\frac{z}{c}+b\text{ Cos. }\frac{5z}{2c},$$

$$y=(c+a)\text{ Sin. }\frac{z}{c}+b\text{ Sin. }\frac{5z}{2c}.$$

Put Cos. $\frac{z}{2c}=p$, and Sin. $\frac{z}{2c}=q$. Then, by the Arithmetic *of Sines*, (Art. 14.)

$$\text{Cos. }\frac{z}{c}=2p^2-1,\qquad \text{Sin. }\frac{z}{c}=2pq,$$

$$\text{Cos. }\frac{5z}{2c}=p(1-12q^2+16q^4),$$

$$\text{Sin. }\frac{5z}{2c}=5q-20q^3+16q^5;$$

Therefore

$$x=(c+a)(2p^2-1)+bp(1-12q^2+16q^4),$$
$$y=2(c+a)pq+b(5q-20q^3+16q^5):$$

by these equations, and the equation $p^2+q^2=1$, p and q may be eleminated; and the result will be an algebraic equation, involving x and y only, which will be the equation of the curve.

Hence it appears, that if the ratio of a to c can be expressed exactly by numbers, the epicycloid will be an algebraic curve, which returns into itself, (*Scholium* to Def.) If, however, a and c be incommensurable, the elemination of z produces an equation of an infinite number of terms, and therefore in this case the curve is transcendental; and in this case also it never returns into itself.

3. As the order of the curve depends upon the ratio of the radii of the fixed and generating circles, it may be worth while to examine some of the more simple cases.

Plate CCLIII. Fig. 14.

First let us take the case of a circle EPC, (Fig. 14.) which rolls on the inside of another AEH, so as always to pass through its centre C. In this case, $b=a=-\frac{1}{2}c$, because a lies now in a contrary direction; therefore, referring the co-ordinates to the line CA, drawn through A, the first point of contact of the two circles, we have by the formula (B),

$$x=\frac{c}{2}\text{ Cos. }\frac{z}{c}+\frac{c}{2}\text{ Cos. }\left(-\frac{z}{c}\right)$$

$$y=\frac{c}{2}\text{ Sin. }\frac{z}{c}+\frac{c}{2}\text{ Sin. }\left(-\frac{z}{c}\right)$$

Now, if in the formulæ for the cosine and sine of $a-b$, a and b being any arcs, (Arithmetic *of Sines*, Art. 10.) we suppose $a=0$, and observe that then Cos. $a=1$, Sin. $a=0$, we shall have Cos. $(-b)=$ Cos. b, Sin. $(-b)=-$ Sin. b, and therefore Cos. $\left(-\frac{z}{c}\right)=$ Cos. $\frac{z}{c}$, Sin. $\left(-\frac{z}{c}\right)=-$ Sin. $\frac{z}{c}$; therefore

$$x=c\text{ Cos. }\frac{z}{c},\ y=0.$$

This value of y shews, that the generating point is always in the axis CA, and since the value of x is evidently the cosine of the arc z, or AE, the distance of the generating point from the centre at any time, is the cosine of the arc that has then been gone over. The epicycloid in this case is therefore AB, that diameter of the fixed circle which passes through the point A where the motion begins.

This conclusion is easily proved synthetically. For if upon O, the middle of any radius of the fixed circle, a circle be described to pass through the centre, and meet a diameter in P, and OP be joined, the angle POE is manifestly double the angle ACE; but POE $=\frac{\text{arc PE}}{\text{PO}}$; and $2\text{ ACE}=2\,\frac{\text{arc AE}}{\text{AC}}=\frac{\text{arc AE}}{\text{PO}}$; therefore arc PE$=$arc AE, and so P is a point in the line, that would be described by the circle EPC rolling on the inside of the circle AEH.

Plate CCLIII. Fig. 15.

4. Next, let us suppose that the circle EP rolls on the outside of another AEH, of the same magnitude, (Fig. 15.) and that the generating point departs from A, the first point of contact of the two circumferences. In this case, $b=a=c$, and we have by formula (B),

$$\text{CR}=x=2c\text{ Cos. }\frac{z}{c}-c\text{ Cos. }\frac{2z}{c},$$

$$\text{PR}=y=2c\text{ Sin. }\frac{z}{c}-c\text{ Sin. }\frac{2z}{c}.$$

Let $v=\frac{z}{c}$, then observing that Cos. $2v=2$ Cos.$^2\,v-1$, and Sin. $2v=2$ Sin. v Cos. v, (Arithmetic *of Sines*, Art. 14.) we have, after substitution, &c.

$$x-c=2c\text{ Cos. }v\,(1-\text{Cos. }v)\ \ldots\ldots\ldots\ldots\ (1)$$
$$y=2c\text{ Sin. }v\,(1-\text{Cos. }v)$$

$$\text{Hence }\frac{y^2}{(x-c)^2}=\frac{\text{Sin.}^2\,v}{\text{Cos.}^2\,v}=\frac{1-\text{Cos.}^2\,v}{\text{Cos.}^2\,v}\ \ldots\ldots\ (2)$$

Let us put $x-c=x'$, so that instead of making C the beginning of the abscissæ, we are now to reckon them from A; and let Cos. $v=p$, and we have from equations (1) and (2),

$$x'=2cp-2cp^2,$$
$$x'^2=(x'^2+y^2)\,p^2.$$

From these two equations, let p be eliminated by the usual method, (Algebra, Sect. 13,) and the result will be

$$4c^2(x'^2+y^2)=(x'^2+2cx'+y^2)^2,$$

the equation of the curve; which shews it to be a line of the fourth order.

This curve has been called the *cardioide*; it has several remarkable properties: For example, if any straight line be drawn through A, to meet the fixed circle again in V, and terminate in the curve at P and P′, then VP and VP′ are each equal to AH; and, consequently, all lines drawn through the given point A, and terminating in the curve, are equal. By this property, any number of points in the curve may readily be found. Again, if tangents be drawn to the curve at the points P, P, they will form a right angle at X their intersection.

Fig. 16.

5. As a third particular case, let us suppose the generating point to be in the circumference of the generating circle, and its radius indefinitely great. In this case (Fig. 16.) PE, the part of the circumference of the generating circle between P, the generating point, and E, the point of contact, is to be reckoned a straight line, which being equal in length to the arc AE, the epicycloid is the same curve as would be described by P, the end of a thread PEH, while it was unwrapped from a cylinder or circle AEH, round which it was wound.

In this case, we have $b=a=$ an infinitely great quantity; and because, in general, Cos. $\left(\frac{z}{c}+\frac{z}{a}\right)=$ Cos. $\frac{z}{c}$ Cos. $\frac{z}{a}-$ Sin. $\frac{z}{c}$ Sin. $\frac{z}{a}$; and Sin. $\left(\frac{z}{c}+\frac{z}{a}\right)$ $=$ Sin. $\frac{z}{c}$ Cos. $\frac{z}{a}+$ Cos. $\frac{z}{c}$ Sin. $\frac{z}{a}$ (Arithmetic *of Sines*); when a is infinitely great, then Cos. $\left(\frac{z}{c}+\frac{z}{a}\right)$

$= \text{Cos.}\ \frac{z}{c} - \frac{z}{a}\ \text{Sin.}\ \frac{z}{c}$, because $\frac{z}{a}$ being an indefinitely small angle, its cosine is equal to radius, and its sine equal to the arc itself; and, in like manner, $\text{Sin.}\ \left(\frac{z}{c} + \frac{z}{a}\right) = \text{Sin.}\ \frac{z}{c} + \frac{z}{a}\ \text{Cos.}\ \frac{z}{a}$: These values being substituted in the formulæ (B), in the case under consideration, we have

$$x = c\ \text{Cos.}\frac{z}{c} + z\ \text{Sin.}\frac{z}{c},$$

$$y = c\ \text{Sin.}\frac{z}{c} - z\ \text{Sin.}\frac{z}{c},$$

for the equations of the curve.

By adding the squares of x and y, we get $x^2 + y^2 = c^2 + z^2$, an equation expressing a property of the curve, which is indeed sufficiently obvious; but the relation of x to y cannot be expressed by an algebraic equation, and therefore the curve is transcendental. This curve is called the *involute* of a circle.

PROP. II.

A tangent to an epicycloid at any point is perpendicular to a straight line drawn from it; to the point of contact of the generating and fixed circles.

Suppose two polygons A 2, 3, 4, E, &c. N 2, 3, 4, E, &c. of a great number of sides to be described about ATE LIII. 17. the fixed and generating circles (Fig. 17,) and that the sides of the one are equal to those of the other. Suppose now the one polygon to roll on the outside of the other; then it is evident that the generating point P will describe a series of arcs of circles, (whose centres are the points 1, 2, 3, 4, E, &c. If now PX be a tangent to a curve that touches all these arcs, at any point of contact P it will be perpendicular to PE, the radius of the arc that is in contact with the curve at P. Imagine now the number of sides of the polygons to be infinite, then the epicycloid may be regarded as the curve that touches all the circular arcs, and E, a point where the polygons touch each other, will be the point of contact of the generating and fixed circles. So that the truth of the proposition is manifest.

COR. 1. Let O′ be the point in which the centre of 18. the generating circle crosses the axis (Fig. 18.), and DVI a circle described on O′, with a radius equal to OP; (the distance of the generating point from the centre of the generating circle), and H the point in which the generating circle touches the fixed circle, when its centre is at O′. Then, if a circle be described on C as a centre to meet the epicycloid in any point P, and the circle DVI in V; and PE be drawn perpendicular to the tangent PX, to meet the fixed circle in E; the normal PE shall be equal to a straight line drawn from V to H. Let O be the centre of the generating circle when the generating point is at P; draw OC to the centre, which will pass through E (by the Prop.) and join OP, O′V; and because CO′=CO, O′V=OP, and CV=CP, the triangles CO′V, COP are equal; therefore the angles HO′V, EOP are equal; now HO′=EO, and O′V=OP; therefore the triangles HO′V, EOP are equal, and HV=EP.

COR. 2. If the generating point be in the circumference of the generating circle, a tangent to the curve at any point P (Fig. 21.) will pass through F, the extremity of the diameter of the generating circle which passes through E, the point of contact of the two circles

SCHOLIUM. From this proposition it appears, that if parallel rays of light fall on the concave circumference of a circle DR *d* (Fig. 19.), they will, after reflection, be tangents to an epicycloid DPA, generated by a circle FPE, which rolls upon a circle AEH, having the same centre as the circle DR*d*, and its radius half the radius of that circle, and double the radius of the revolving circle; also the generating point being supposed to set out from A, the middle of the perpendicular radius CR. For let the generating circle be in any position EPF, P being the generating point, and CEF that radius of the circle DFR, which passes through the points of contact of the circles; draw FG perpendicular to the diameter D *d*, and join FP, which will touch the epicycloid at P, (Cor. 2.) The angle EFP at the circumference is half an angle at the centre, on the same arc, and therefore is measured by $\frac{\frac{1}{2}\ \text{arc PE}}{\frac{1}{2}\ \text{EF}} = \frac{\text{arc PE}}{\text{EF}}$, that is by $\frac{\text{arc EA}}{\text{EC}}$; but this last arc is also the measure of the angle ECA, or CFG; therefore the angles PFC, CFG are equal; and hence, if GF be the incident ray, FP is the reflected ray. See OPTICS.

PLATE CCLIII. Fig. 19.

Hence it appears, that in this case the epicycloid is the *catacaustic* curve, or the curve which passes through the intersection of any two parallel and contiguous rays, after they have reflected from the concave surface. This curve is beautifully shewn on milk in a bowl, by the reflection of the sun's rays from the polished concave surface which rises above the surface of the milk.

Fig. 20. When rays diverge from one end of the diameter of a circle, and are reflected from the inside of the circumference, in this case also the catacaustic curve is an epicycloid, viz. the *cardioide*: (See Prop. 1). For let the circle EPF roll on the outside of the equal circle AED, the point P departing from A, and generating the epicycloid APH, through E, the point of contact of the circles, draw CEF, to meet the generating circle again in F; on C as a centre, with CF as a radius, describe a circle HF*d*; draw FP to the generating point, and FH to the end of the diameter of the circle HF*d*, which meets the epicycloid. Because AE and EP are equal arcs of equal circles, the angle ACE at the centre is double the angle EFP at the circumference. But because CF=CH, and consequently the angle CHF=CFH, the angle ACE is double the angle CFH; therefore the angle CFH is equal to the angle CFP; and consequently HF being any incident ray, FP is the reflected ray; moreover, FP is a tangent to the epicycloid. (Cor. 2).

NOTE. In the remaining propositions, we shall always suppose the generating point to be in the circumference of the generating circle.

PROP. III.

Fig. 21. Let H be the middle of HPA, an exterior epicycloid, C the centre of the fixed circle, and HVD the generating circle when its centre is in the axis CH. On C describe an arc of a circle to pass through P any point in the epicycloid, and meet the generating circle in V, and join HV. The chord HV is to the epicycloidal arc HP, as the radius of the immoveable circle to the sum of the diameters of the immoveable and generating circles.

Take *p*, a point in the epicycloid, indefinitely near to P; describe the arc *pv*, and join H*v*; let FPE, *fpe*, be the generating circle at P and p; and FE, fe, the diameters which pass through E, e, the points in which it touches the arc DA; join FP, fp, which will be tangents to the curve at P and p, (Prop. 2. Cor. 2.); and draw the lines PE, pe, which will be normals to the curve; draw Vr perpendicular to Hv; also fs perpendicular to FP, and en perpendicular to PE, and join Ff.

Because EP$=$DV, (Prop. 2. Cor. 1.), therefore PF $=$VH; and in like manner $pf=v$H; also, supposing the tangents FP, fp, to meet in K, we have, by rejecting quantities which are infinitely small in respect of others, K$f=$Ks, HV$=$Hr, pf—PF$=$Hv—HV$=rv$; and PK$+$Kp $=$ the epicycloidal arc Pp; and since pf—PF$=(p\text{K}+\text{KP}+\text{P}s)-(\text{P}s+s\text{F})=p\text{K}+\text{KP}-s\text{F}$, we have $rv=$arc Pp—sF, and arc P$p=rv+s$F.

The indefinitely little triangles Ffs, vVr, are similar; for the angles at s and r are right angles, and (considering the arc Vv as coinciding with its tangent) the angle rVv is equal to the angle DHV, or to EFP, that is to Ffs; therefore Vv : Ff :: rv : Fs; but V$v$$=Ee$, and E$e$ or Vv : Ff :: CE ($=c$) : CF ($=c+2a$); therefore $c:c+2a::rv:\text{F}s$, and by composition $c:2c+2a::rv:rv+\text{F}s$, that is, $c:2c+2a::rv:$ arc Pp. Now rv is the increments of the chord HV, and Pp is the corresponding increment of the arc HP; and it appears that the chord HV and arc HP, which begin together, are augmented by increments which have to each other the constant ratio of c to $2c+2a$; therefore the chord HV, and arc HP themselves, will have to each other the same ratio.

Cor. The arc HPA, half the epicycloid, is a fourth proportional to the three straight lines, c, $2c+2a$, and $2a$.

Scholium 1. If the epicycloid be interior, then the chord of the generating circle determined as in the proposition, will be to the epicycloidal arc as the difference of the diameters of the fixed and generating circles to the radius of the fixed circle. The proposition is demonstrated in this case exactly as in the other.

2. If we suppose the radius of the fixed circle to be infinite, its circumference is to be reckoned a straight line, and the ratio of c to $2c+2a$ is that of c to $2c$, or of 1 to 2. The curve is then the common cycloid; and the proposition agrees with what has been shewn concerning that curve.

3. It appears that any arc s of a cycloid and epicycloid, may be rectified (that is, a straight line may be found equal to it), when the curve is described by a point in the circumference of the generating circle. When the generating point is within or without the generating circle, the rectification of the curve is reducible to that of the ellipse; and therefore cannot be effected but by approximation. See Fluxions.

Prop. IV.

Plate CCLIII. Fig. 21.

The same things being supposed as in last proposition, let PE, a normal to the curve at P, meet the circular base of the epicycloid in E; and let DV, the chord of the generating circle, be drawn. The area of the space bounded by DH, the diameter of the generating circle, HV the circular arc, and VD the chord of its supplement, is to the area bounded by DH, and by HP the epicycloidal arc, PE the normal, and DE the arc between the middle of the base and normal, as the radius of the fixed circle to the sum of three times its radius, and twice the radius of the generating circle.

Take p indefinitely near to P; describe the arc pv; join Dv, and draw vr perpendicular to DV, and en perpendicular to EP. And because the equal arcs Vv, Ee, are indefinitely small, they may be considered as coinciding with tangents, and Vvr, Een may be taken as rectilineal triangles, which will be equal, because, besides the equal angles at r and n, the angle eEn is equal to EFP, and vVr to DHV$=$EFP; therefore $en=vr$. And because it was shewn in last proposition that rv or en is to Pp, the indefinitely little arc of the epicycloid, as c to $2c+2a$; therefore by composition, $rv:ne+\text{P}p::c:3c+2a$. Now the infinitely little triangle Drv, and trapezoid nPpe, have the same altitude; for Dr or Dv is equal to Pn or pe; therefore the triangle Drv is to the trapezoid nPpe as rv, the base of the former, to $ne+\text{P}p$ the sum of the parallel sides of the latter; that is as c to $3c+2a$. But the triangle and trapezoid are the increments by which the circular space DHVD, and the epicycloidal space DHPED, are augmented, in consequence of the change of position of the normal from PE to pe; therefore, these spaces are continually increased by quantities which have to each other the constant ratio of c to $3c+2a$; and consequently the spaces themselves have the same ratio.

Cor. The whole epicycloidal space DHPAD is to half the area of the generating circle as $3c+2a$ to c.

Scholium. When the radius of the circular base is infinitely great, the epicycloid becomes the common cycloid; and the ratio of $3c+2a$ to c becomes the ratio of $3c$ to c, or 3 to 1, as was demonstrated in Prop. 8. of the Cycloid.

Prop. V.

Plate CCLIII. Fig. 22.

If a thread be fastened at A, one extremity of an epicycloid, and applied along the curve APH, so as to terminate at H, its middle; then, if it be unfolded, so that PX, the part disengaged, may always be extended into a straight line, its extremity X will describe another epicycloid HXZ, similar to the epicycloid APH.

Let HVD and FPE be the generating circle, when it passes through the points H and P respectively. On C the centre of the fixed circle describe the arcs HFR and PV; join HV, and PE; and make EF to FY as CE to CF, that is as c to $c+2a$, and join XY. Because PF is equal to VH, and the arc PH to the straight line PX, PF : XP :: $c:2c+2a$ (Prop. 3.) and by conversion, PF : FX :: $c:c+2a$, that is, by construction, as EF to FY; hence the triangles PFE, XFY are similar; the angle FXY is consequently a right angle; and a circle described on FY as a diameter will pass through X, and touch the arc HR in F. Again, because the angles XYF, PEF are equal, the arc XF is similar to the arc PF, and *arc* XF : *arc* PF :: *chord* XF : *chord* PF. But XF : PF :: YF : FE (or by construction,) :: CF : CE :: *arc* FH : *arc* ED; therefore *arc* XF : *arc* PF :: *arc* FH : *arc* ED : But the arc PF is equal to the arc ED, because, by the generation of the curve, *arc* AE$=$ *arc* EP, and *arc* AED$=$*arc* EPF; therefore the arc XF is equal to the arc FH: Hence it follows that the point X is in an epicycloid HXZ, of which the arc HR is half the base, and FXY the generating circle. And because, by construction, EF : FY :: CE : CF; the diameters of the generating circles, have to each other the same ratio as the diameters of the fixed circles; therefore the epicycloids will be similar.

Cor. The radius of curvature at any point in an exterior epicycloid is to the chord of the arc of the generating circle, between that point and the base in the constant ratio of the sum of the diameters of the fixed and generating circles, to the sum of the radius of the former, and the diameter of the latter. For XP is the radius of curvature at X, and FX the chord of the generating circle, and $PF : FX :: EF : FY$. But it has been shewn that $EF : EC :: FY : CF$, from which it follows, that $EF : FC :: FY : YC$, and $EF : FY :: FC : YC$; therefore $PF : FX :: FC : YC$, and $PX : FX :: FC + YC : YC :: 2CF + FY : CF + FY$.

This proposition will apply to an interior epicycloid, by subtracting the diameter of the generating circle, or its multiples, instead of adding them. (ξ)

EPIDEMIC Diseases. See Medicine.

EPIDENDRUM. See Botany, p. 315.

EPIDERMIS. See Anatomy.

EPIGÆA. See Botany, p. 217.

EPIGRAM, (from επι, *upon*, and γραφειν, *to write*,) originally signified merely, as its derivation denotes, an *inscription*, generally upon some public edifice, monument, or remarkable spot. Even among the Greek writers, however, the word *epigram* gradually acquired a more extensive signification, and was almost indiscriminately applied to any short poetical composition, descriptive of local scenery, commemorative of some striking event, or illustrative of some peculiar moral feeling or affection of the mind. Of such ancient epigrams or inscriptions, we have many beautiful specimens in the Greek *Anthologies*; and it is justly remarked by Mr Drake, in his *Literary Hours*, that a number of these productions bear, in their style and character, a very close analogy to the modern sonnet.

Among the Romans, the meaning of the word appears to have been much restricted; with them an epigram was usually understood to denote a short satirical effusion; and, in this sense the name has generally been adopted in modern times.

The characteristic requisites of an epigram are expressed in the following couplet:

> "What is an epigram?—A dwarfish whole,—
> "Its body brevity—and wit its soul."

Shortness, indeed, is peculiarly essential to the composition of an epigram; when spun out to any considerable length, it loses its epigrammatic character, and must be referred to some other department of poetry. The wit of an epigram generally consists in some unexpected satirical point or allusion, which pleases us, either in consequence of the surprise it excites, or the ingenuity of the thought, or rather, perhaps, from both combined. But if we look to the origin of the term, or to the best examples of this kind of writing, in ancient and modern times, it will not appear that satire is essentially required in an epigram; indeed, many of the most beautiful specimens of this species of composition have no allusion that can be deemed satirical.

There is no British author, we believe, who, like Martial among the Romans, has distinguished himself by the composition of any considerable number of epigrams, in his native language; but the works of some of our most eminent poets abound in epigrammatic turns; and we have ample collections of the scattered effusions of our wits in this kind of writing. It is very evident, however, that we are indebted to the Greeks and Romans for a great deal of that point which is to be found in modern epigrams. See the Greek *Anthologies*. Bland's *Translations from the Greek Anthologies*. Lessing, *Ueber das Epigramm*. *The Festoon, or a Collection of Epigrams, &c.* by Mr Graves. *The British Martial*, 2 vols. 12mo. (z)

EPILEPSY. See Medicine.

EPILOBIUM. See Botany, p. 199.

EPIMEDIUM. See Botany, p. 128.

EPINAL, or Espinal, a town of France, and the principal place in the department of the Vosges. It is situated on the river Moselle, near the mountains, and had formerly a celebrated abbey, a college, an hospital, and four convents. Its commerce consists of corn and grain of all kinds, of hemp, lintseed, colzat, and wood. Its principal manufactures are those of paper, earthenware, and pipe-clay. Oil is made in great quantities; and there are also manufactures of thread, linen, and cotton stockings. Its fairs are held on the 1st and 3d Wednesday of every month. Population 7000. (w)

EPIPACTIS. See Botany, p. 314.

EPIRUS, was a region in ancient Greece, bounded on the east by Macedon and Thessaly; on the south by the Ambracian Gulf; on the west by the Ionian Sea; and on the north by the Ceraunian Mountains. It consisted anciently of three divisions; Chaonia, lying towards the north; Molossis, the middle or inland province; and Thesprotia, extending on the south from the Ambracian Gulf to the sea. Many cities of considerable magnitude adorned this territory, of which we shall only mention Ambracia, built near the mouth of the river Arachtus; which was about three miles in circumference, and became the residence of the Æacidæ, who reigned in Epirus; and Dodona, said to have been founded by Deucalion as early as the flood, and rendered illustrious by the temple and oracle of Jupiter Dodonæus, which were accounted the most ancient and venerable in all Greece. The lands which stretched along the sea coasts were fertile and well cultivated; but the interior parts were covered with vast forests, and were almost entirely barren. The horses of Epirus were famous from the most remote antiquity; and the dogs, which the Romans called *Molossi*, from the district where they were reared, were every where purchased and employed in hunting.

If credit be due to Josephus, Dodanim, the grandson of Japhet, having first settled in the island of Rhodes, either went over to the continent himself, or sent thither some of his descendants, to people this region. From him the inhabitants were called Dodonæans, and their principal city Dodona: but in a short time after, a number of different tribes migrated thither, and took possession of those places which were not yet occupied. Having no bond of union, they were almost constantly engaged in war; and though this inspired them with the most exalted courage, it rendered the introduction of civilisation and refinement slow and difficult.

During the time that the country was divided into a number of independent states, each governed by its own king with the most despotic authority, the history of this region is altogether unworthy of attention. It was only when the kings of Molossis had gained the ascendency over their neighbours, and had reduced the whole under their sway, that this region was denominated Epirus, from a Greek word which signifies *the continent*. Pyrrhus, the son of Achilles, was the first of the race of the Æacidæ, who assumed the sceptre. But though the ancient annalists generally begin the history of this country with his accession after the siege of Troy, yet the exploits which they attribute to him, are certainly disfigured by poetical invention. The names of his descendants, who governed Epirus till the Persian war, are buried in oblivion. When Xerxes invaded Greece, Admetus held the sceptre; but as he had refused to assist either party, Themistocles, after the termination of the war, rejected, with disdain, his offers of alliance; but when that celebrated Athenian was banished from the ungrateful country, which his skill and bravery had saved, he found an honourable asylum in the court of the prince, whom he had formerly contemned. He was succeeded by his son Tharymbas, who went to Athens for the sole purpose of conveying the literature, which was there cultivated, to his own country, and who, on account of the wise laws which he afterwards enacted, was enrolled among the ancient lawgivers. His descendants, Alcetas, Neoptolemus, Arybas, Alexander, Aecides, Alcetas II. reigned in succession.

Our attention, however, is powerfully arrested by Pyrrhus II. the son of Aecides, who, when an infant, had been saved from the fury of the rebels, who drove his father into exile. This prince, nursed by misfortune, and educated amid dangers in a foreign land, was seated upon the throne of his ancestors by Glaucius, king of Illyricum; was afterwards stripped of his dominions by Neoptolemus, his great uncle; and was then sent by his brother-in-law, Demetrius, with whom he lived in exile, as a hostage to Ptolemy, king of Egypt. Having conciliated the affection of that monarch, by his assistance he again ascended the throne of Epirus; joined the Tarentines in a war which they waged with the Romans; embarked a powerful army for Italy; and, after encountering a dreadful tempest, arrived at Tarentum. Taking the field at the head of his own forces and those of his allies, he defeated the Romans upon the banks of the Siris; but whilst he poured his victorious army over the territories of his enemies, he was completely routed upon the plains of Asculum, where he was dangerously wounded. Collecting the relics of his forces, he again encountered the Romans near Beneventum; but, after the greatest part of his army had fallen around him, he was obliged, not only to leave the field of battle, and retire to Tarentum, but to abandon Italy, and return home. To retrieve his reputation, and supply his exhausted treasury, his restless spirit then invaded the kingdom of Macedon, overthrew Antigonus in a pitched battle, drove him from his throne and his dominions, and took possession of the kingdom. Fired with success, and with the hope of still greater conquests, he burst into the Peloponnesus with a mighty army; but the bravery of the Lacedemonians arrested his progress: and having lost his son, and avenged his death, in a bloody but an undecisive engagement, he directed his march to Argos, and, by stratagem, made himself master of that city. But Antigonus, with an army which he had collected, and Arcus with his Lacedemonians, who had closely pursued him, entered the city during the night, immediately attacked his unsuspecting army, and the morning discovered the terrible carnage which their fury and revenge had made. Pyrrhus, who now perceived that all was lost, endeavoured in vain to retire from the city with the wreck of his forces; and, whilst he performed prodigies of valour, a woman who surveyed the battle from the top of a house, beheld the enraged monarch below her ready to plunge his sword into the breast of her son who had wounded him, and, in order to prevent the blow, she threw furiously a tile which she had rent from the roof, upon the head of Pyrrhus, which, felling him to the ground, saved her son, and avenged her country. The head of the monarch was severed from the body, and the remains of his army were made prisoners.

The kingdom, after his death, was successively governed by Alexander II. Ptolemy, Pyrrhus III. and Deidamia. But though this princess succeeded her father, a female hand was too weak to keep her fierce and turbulent subjects in subjection; a conspiracy was formed against her, and in the temple of Diana, to which she had fled for refuge, she was barbarously murdered. The Epirotes then formed themselves into a republic; but instead of vindicating, by their future valour, that liberty which they had shamefully purchased, they gradually sunk from the proud station which they formerly occupied, and became subject to the king of Macedon. But when the Macedonians under Philip yielded to the superior destiny of the Romans, the Epirotes received their liberty from the generosity of the conquerors. To free themselves from the debt of gratitude, they entered into an alliance with Perseus the son of Philip, against their benefactors, and endeavoured to prop the power which had long oppressed them. The magnitude of their ingratitude, however, was equalled by its punishment. After sharing in all the adverse fortunes of Perseus, the authors of the war beheld Paulus Emilius, with an exasperated army, enter their territories; divide among his daring veterans the wealth which had been amassed for ages; level in the dust the cities which their fathers had decorated; condemn to slavery a hundred and fifty thousand of the wretched inhabitants; and transport the chief men of the country to Rome, and to perpetual imprisonment. The glory of Epirus was now for ever extinguished. When the Consul Mummius had reduced Corinth to ashes, and dissolved the Achaian league, Epirus became a Roman province. In this state of degradation it remained till the division of the Roman world, when it shared the fortunes of the eastern empire. But when the French and Venetians, under the Marquis of Monserrat, had stormed Constantinople, and divided the Greek provinces, Michael, a bastard of the house of Angeli, fled from the camp of the Latins, and, seizing upon Epirus, Aetolia, and Thessaly, laid the foundations of a powerful dynasty, and claimed the honours of an independent throne. Theodore Angelus succeeded to the power and ambition of his brother; took prisoner Courtenay, who had been elected emperor of Constantinople, and had invaded Epirus, expelled Demetrius from his kingdom of Thessalonica, and assumed the lofty appellation of *Emperor*. This dawn of glory was soon overcast. Amurath II. having driven his descendants from Epirus, bestowed the dependant sovereignty upon the family of the Castriots, who governed it with varied success. George Castriot, known by the name of Scanderbeg, was the last of that race who held the sceptre. From him the territory passed to the Venetians, but the Turks soon wrested it from their hands, who still hold it in inglorious subjection. It is now known by the name Albania. (N)

EPISTYLIUM. See BOTANY, p. 329.

EPITAPH, signifies an inscription upon a tomb, and is generally designed to commemorate the name and virtues of the deceased. The practice of bestowing epitaphs on the dead, which appears to have prevailed from the most remote ages, among those nations that have attained any degree of civilization, seems to have originated, partly from the natural vanity of mankind, which prompts the desire of being remembered after death, and partly from the affectionate inclination of friends, to perpetuate the merit of their departed relatives.

An epitaph ought to be short and simple, containing merely the name, and a brief character of the deceased. In the case of persons of great eminence and notoriety, the name, perhaps, is of itself almost sufficient; but if the individual be of less note, some more ample designation is requisite. Laboured characters, however, and exaggerated representations of merit, are misplaced on a tomb-stone; to real worth and dignity they give no additional elevation; and, when joined to insignificant names, they are apt to excite very opposite feelings from those intended to be produced in the mind of the reader. The form and tenor of every epitaph ought to be solemn and impressive; the introduction of any ludicrous expression or allusion, in such a situation, must excite disgust.

For a character of the style best adapted to this kind of composition, we refer our readers to Dr Johnson's *Essay on Epitaphs*, where they will also find a minute criticism on the epitaphs of Pope. (*z*)

EPITRITES, in music, is an interval whose ratio is $\frac{5}{4}$, $= 254\,\Sigma + 5\,f + 22\,m$, and is the FOURTH *Minor*; which see.

EPIZOOTY, derived from επι and ζωον, signifies a plague or murrain among animals. In the common acceptation of the term, *murrain* is limited to distempers among useful and domesticated animals, whereas *epizooty* comprehends those pestilential ravages to which the whole living creation is liable.

The frequent recurrence of distempers among the domesticated animals which form the principal subsistence of mankind, has attracted particular attention to their origin, progress, and the means of cure, or of averting the danger. At present, however, we shall chiefly restrict our remarks to some historical notices of the more singular and decided epizooties which have threatened the extirpation of animals in different countries.

On ascending to the most ancient periods of history, we discover a destructive epizooty in one of the plagues of Egypt, extending to all domesticated animals. This is described by Moses in unequivocal terms, "Behold, the hand of the Lord is upon the cattle which are in the field, upon the horses, upon the asses, upon the camels, upon the oxen, and upon the sheep; there shall be a very grievous murrain;" and there is one remarkable peculiarity indicated here, which identifies it with later epizooties, as being "a boil breaking forth with blains upon man and upon beast." It has further been exemplified, that the plague among mankind is frequently accompanied or followed by an epizooty.

Omitting the accounts of ancient poets who treat of such distempers, we find several allusions to destructive epizooties, in the writings of authors, long preceding the Christian era. Plutarch speaks of an epizooty in the time of Romulus, as a great mortality of men and beasts in Italy, when they perished almost immediately on the attack. Dionysius Halicarnassus and Livy, particularly the latter, describe epizooties, followed by pestilence, at different intervals of the fifth century anterior to Christianity, also in Italy. Livy likewise relates, that immediately after the capture of Agrigentum by Marcellus, in the year 212 before Christ, mankind and animals were alike the victims of a pestilential disorder; and if we could trust to Silius Italicus, the symptoms of it might be described.

In the earlier centuries of the Christian era, repeated instances of epizooty are found in the works of the ancients. Tacitus speaks of a terrible mortality among mankind and animals, arising "without any sensible intemperance of the weather," which swept off all ages indiscriminately, in the year 65; and the Roman territory was ravaged by a similar pestilence about the year 190.

In the fourth century, we learn that the means adopted to avert a general epizooty in Europe, was marking all animals on the forehead with a red-hot iron in form of a cross; and the violence of this remedy probably produced that efficacy which is ascribed to it. Vegetius Renatus, who flourished in the same century, suggests various cures for the different pestilential disorders of cattle.

Descending still lower, many examples of epizooty are found in contemporary authors; and it has been remarked, that "in the interval between 810 and 1316, a period of darkness, horror, and calamity, history characterizes not less than twenty epizooties, more or less destructive, which ravaged different parts of Europe." Of these, five or six attacked cattle, two horses, and twelve animals in general. Four were likewise destructive of mankind.

Hitherto, all information concerning such diseases, had consisted in brief remarks and notices on the simple existence of the malady; but, in the sixteenth century, the subject was examined with more attention. Fracastori, an Italian physician, witnessed an epizooty among cattle in the year 1514, which first appeared in Frioul, whence it spread by contagion to Venice, and from thence to Verona. A similar pestilence raged among sheep in France during the following year, and both are described as an eruptive fever, narrowly resembling the small-pox. Few characteristics are preserved, except that it was extremely contagious, and that the animals which exhibited no eruption perished. However, on the re-appearance of that or another malady in 1578, it was more plainly designated small-pox, and apprehensions were some time after entertained, that man might be liable to infection. The Venetian government, therefore, on an universal dysentery attacking the citizens of Venice and Padua, issued an edict in 1599, prohibiting the sale or distribution of the flesh of cattle, or milk, butter, or cheese, under pain of death. It had likewise been observed, that such distempers proceeded from the east, and that some diseased cattle had been brought from Hungary and Dalmatia, where the malady became so common, that another market was sought out for the two cities.

In 1661, after a hot, dry summer, a kind of phrensy spread among animals, especially horses, cattle, and sheep; but we do not know if it was contagious. It was principally confined to the northern climates, and, on opening the head, one or more worms were found in the substance of the brain. Numbers of fasciolæ or intestinal worms, were also discovered in many animals perishing by an epizooty in 1663 and the two succeeding years, and were then considered the sole cause of the distemper. Analogous symptoms, though it does not appear whether the malady was equally fatal, attacked almost the whole cattle in the Danish territory in 1674.

France was visited by an epizooty among the black cattle in 1682. The animal functions were uninterrupted until the attack, when sudden death ensued. This was accompanied by gangrene of the tongue and intestines, and the former sometimes came away in pieces. Those who tended the cattle, and neglected proper precautions, are said to have been infected by the disease, and to have died. Its progress was regular, and marked by astonishing rapidity; and it was observed to be at the rate of 12 English miles in 24 hours. Thus it spread from the frontiers of Italy to Poland.

The knowledge of the various distempers to which animals are subject, had wonderfully increased in the commencement of the eighteenth century; and opportunities for observation seemed to keep pace with a general anxiety to investigate their cause. Between the years 1705 and 1711, a distemper called the flying chancre or bubo, which the latest authors denominate a real *plague* or murrain, was found to be making terrible ravages in Europe. It had been imported by a single infected ox brought into the Venetian states from Hungary and Dalmatia; and it was thence disseminated throughout the Roman territory and the kingdom of Naples, sweeping away almost the whole cattle in its progress. It did not reach France until the year 1714; and, in the same year, having been some time prevalent in Britain, the most vigorous means for repressing it were adopted by government. All the animals attacked were ordered to be destroyed, and buried deep in the earth, and a compensation allowed to those who thus lost their property. The violence of the disease did not subsist above three months, during which time the counties of Essex, Middlesex, and Surrey, lost 5867 cattle, old and young. At this time it was observed, that on cows being brought to a pond to drink, many became giddy, fell down in convulsions, bled copiously at the mouth and nose, and died. Other nations suffered more severely; Piedmont lost 70,000 cattle; Holland, not fewer than 200,000; and the full extent of the epizooty throughout Europe, was calculated to have destroyed 1,500,000 animals. All these perished of the infection disseminated by the single diseased ox from Hungary. But the disease was marked by considerable distinctions in different countries; and it seems that some of its symptoms bore little resemblance in one place to what were seen in another.

An intelligent German physician, Andrew Goelicke, had an opportunity of making many interesting observations on an epizooty among black cattle in 1730, which spread by contagion; and the attention of M. De Sauvages of Montpellier was soon afterwards directed to a distemper among cattle, horses, mules and asses. This was a blane of the tongue, degenerating into a cancerous ulcer, whereby that organ was almost totally destroyed. The commencement and termination of the disease were sometimes witnessed within 24 hours. The people of the city of Nismes did not escape; and on looking into historical record, several Parisians had apparently been affected by a similar complaint, in the year 1571. The tongue of the diseased animals now fell to pieces, while they fed and performed their ordinary functions.

One of the most destructive epizooties known to have appeared, again ravaged Europe, but for at least ten consecutive years from about 1740. Its virulence, however, was greatest in 1745 and 1746. It was generally thought to have originated at the siege of Prague, and to have been disseminated from Bohemia by means of distempered cattle. This disease was exhibited by the same general symptoms of shivering, palpitations of the heart, difficult respiration, a frequent cough, coldness of the hoofs and horns, cessation of the natural evacuations, and sometimes the animal fell down as if struck by apoplexy. Eruptions covered those which survived the violence of the attack. But it was evidently contagious, and the strongest precautions were adopted to repress the infection. Former experience had proved, in the history of an epizooty, by Lancisi, that they could not be too strictly adopted; for certain drivers having brought their cattle to a fair in Italy, in the year 1718, a prohibition was issued against holding it, in order to prevent the dispersion of the cattle. However, the drivers rather than be disappointed of a market, conducted them by private roads to Rome, and sold their cattle at a low price. Immediately afterwards, a contagious distemper spread through the whole Roman territory, and destroyed 300,000 animals. Notwithstanding similar precautions now enforced, and burying the diseased cattle, as well as interdicting the sale of their flesh, untoward accidents happened; and if we are to credit the accounts of the times, contagion was disseminated by the skin. But at different places in France, guards were posted to prevent any cattle from approaching them, whereby the stock was preserved in health, though the malady was making rapid advances in the surrounding country. The Marquis de Courtivron instituted numerous experiments regarding this distemper, from which he concluded that it exhibited itself on the fourth day from infection, that the ninth was its crisis, and that the contagion could spread only by direct communication between two animals.

Whether this epizooty totally ceased within ten years, or, indeed, whether it has ever been completely extirpated, may be the subject of dispute. Perhaps the renewal of epidemics is judged to be such, only because observations are not sufficiently extensive to prove that they are always subsisting. In the course of the year 1746, a new remedy, inoculation, had been attempted at Brunswick, and in an epizooty which appeared in Holland during 1755, the same remedy was repeated, though with little success, and recommended in Britain by Dr Layard, in the year 1757. The distemper in the latter country was considered absolutely similar to the small-pox; and the infection was said to have been brought from Holland by two white calves of a favourite breed, or by two skins of diseased animals. Whatever was the case, many cattle perished of it.

Different epizooties appeared about the same time among the cattle, horses, and reindeer of France, Austria, Finland, and Lapland. Swine, dogs, and even poultry, are said to have been attacked by it. Russia did not escape; and, if we can credit the relations given, the malady was propagated by the skin of an infected bear, even to the destruction of mankind. These epizooties were either perpetuated or renewed during the years immediately subsequent, and, if possible, raged more extensively among the various genera of animals. The horses of Switzerland, the cattle of other countries, sheep, and particularly lambs, were swept away in thousands. In 1764, dogs were attacked throughout France, poultry in Spain, and the rest of the feathered tribes all over Europe, The milk of infected cows spread the contagion; for those animals supplied with it were covered with pustules; and people who suffered in the same manner experienced great difficulty of deglutition, and burning heat in the throat.

For some years, about this period, an epizooty raged among the black cattle of Holland. It first manifested itself in the province of Groningen, especially in the village of Haren, and spreading insensibly, carried off the whole cattle belonging to a neighbouring district. Its attack was announced all at once by the animal becoming dull, and rejecting drink. Fever and shivering, attended by a general prostration of strength, followed; the ears and horns grew cold; a cough became unremitting; a purulent matter was discharged from the nose, and an ichorous fluid flowed from the eyes. The hide was puffed up, and a crackling, like that of parchment, was heard on pressure. Some were attacked by diarrhœa, others by constipation from the fourth to the sixth day of the disease, and they died from the second to the eleventh day after its commencement. The blood of the animals then proved thin; the intestines inflamed and putrid; the lungs gangrenous; the gall bladder always greatly enlarged; and many fasciolæ were in the liver. The symptoms were generally the same; and Camper, who strictly watched the appearance, progress, and issue of the malady, pronounced it a contagious putrid fever. Animals once attacked were never liable to its recurrence, or at least very rarely; hence Camper, from that and other circumstances, concluded, that, to repress it, four principal objects were to be kept in view. 1. To endeavour to prevent the malady, and abate its virulence. 2. To preserve the fluids from corruption. 3. To preserve the strength of the animal. 4. To cleanse the intestines immediately on the appearance of the disease. It is unnecessary to enter on any detail concerning these different principles; but respecting the first, in Camper's opinion, there was no means of guarding against contagion, but by excluding diseased animals, and all substances by which infection might be communicated. He also conceived that inoculation was the most probable method of averting the malignity of the distemper. He was not discouraged by the doubtful issue of former experiments, and even repeated them on a more extensive scale. His first essays, which he did not consider particularly successful, saved 46 out of 112 infected animals: again, 46 were preserved out of 92; and, if cows were not far advanced in gestation, three-fourths survived the malady by inoculation. Notwithstanding this naturalist's anxiety to proceed still more extensively, it was found impracticable to persuade the proprietors of the animals of the expediency of intentional infection, whence the system of inoculation was soon brought to a close. It has nevertheless been successfully practised elsewhere, particularly in Denmark; and in the first three years of the experiment, less than a sixth part of the infected cattle was lost. Strong prejudices, perhaps they can scarcely be called imprudent, were opposed to the same proposal in England, when an inoculator applied to the privy council for permission to carry the variolous matter from Hampshire into other counties. It was then remarked, that the introduction of a disease where it did not exist, might spread by contagion beyond the power of experiment to cure, and that it was already known the malady might be extirpated by killing the cattle. Camper established several important points: such as, that the epizooty imparted by inoculation, was exactly similar to that communicated by natural infection; that it was of a much milder nature; as also, that animals infected in this way, resisted both natural contagion and the consequences of inoculation. This malady proved extremely destructive in Holland; for it appeared, that of 286,647 animals attacked, not fewer than 208,354 died.

The same disease seems to have made its way into Picardy, by the introduction of a diseased cow, as was supposed, from the Low Countries, in the year 1771; and after being subdued, broke out with redoubled violence in 1773. Its first and principal ravages were in the province of Hainault and Picardy, whence it became widely extended. Numerous remedies were tried, but their inefficacy being proved, the extirpation of the malady was sought in the destruction of the infected animals. This disease, after minute observations by many intelligent persons, was identified with that which had been so fatal in the years 1711 and 1745, and though different symptoms were exhibited in the animals attacked, it was as before judged to be the same in all. But Vicq d'Azyr now made experiments, tending to establish, that inoculation was not an effectual antidote; and this result is said to have coincided with the experiments of the Marquis de Courtivron some time before. The British government had adopted the precaution, of ordering all infected cattle to be killed by strangulation, and without effusion of blood; that their carcases should be buried deep in the earth, with the hide entire; and that all fodder, litter, and every thing else which might communicate the contagion, should be buried along with them. Similar ordinances were promulgated by the government of France, and renewed for several years, strictly enjoining the destruction of the diseased animals, and that their carcases should be buried, and their skins cut in pieces, in order to prevent any dealings for them. Indemnification was promised to those who thus lost their property, and a premium offered to whoever should substitute horses or mules for cattle in agricultural operations. By these and other prudent regulations, this, which is one of the epizooties best characterized in history, was repressed.

During the period that contagious distempers swept away the cattle of Europe, a malady even more rapid in its progress appeared among those of the West Indies. Its effects seem to have been more minutely traced in Guadaloupe, where it first attacked black cattle, then spread to horses, and is said even to have affected man. Animals apparently well, in good condition, and feeding as usual, were suddenly seized with shivering fits, attended by convulsions in the spine and abdomen, which sometimes carried them off in an hour. Almost all the negroes who opened the dead cattle, had boils rising on their arms, attended by much fever; and those feeding on their flesh, experienced the like symptoms. But examples were given of several, who actually died from infection of the distemper. Something similar was witnessed in France, where persons skinning the animals, themselves died of the contagion, the effects of which were immediate.

Between the years 1780 and 1790, a pestilential disease prevailed among the cattle in the northern counties of Scotland, vulgarly denominated *hasty*, from the rapidity of its progress. The animal swelled, its respiration was affected, there was a copious flow from the eyes, it lay down, and sometimes expired in a few hours. This distemper was ascribed, as has been the case in many foreign countries, to the damp and shaded pasturage of copses, and with the decay of the wood the epizooty has declined. The peasantry attempted to cure the infected animals, and prevent contagion of the healthy, by fumigation with the smoke of *need fire*, which was fire obtained by the friction of a certain wooden apparatus erected on an islet.

The eastern parts of Asia were visited by a destructive epizooty among the horses, especially in 1804; and after the severity abated in 1805 and 1806, it was renewed with uncommon virulence in the year 1807. In so far as we can learn, this distemper consisted of a sudden swelling, attended by shivering fits, an abscess formed most commonly in the head, and the animal died in twelve hours at farthest. But, in many instances, its commencement and termination were infinitely more rapid, and death was known to ensue in half an hour. The malady was observed early at Ochotsk. Cattle, reindeer, and horses, all suffered; and of the last, a caravan consisting of eighty, preserved only ten. The Russian government of those distant regions, in order to repress the disease, ordered all the animals perishing of it to be burnt; but before its nature was well understood, the *Jakatchians*, to whom horse flesh is grateful, unwilling to lose such a source of subsistence, fed upon it. Most of those who had done so, died within a day or two; and a few lingered a fortnight. Those who escaped were attacked by severe swellings in the upper lip and cheeks, which broke out, and left great scars.

Besides these epizooties, of which a general historical view has been given, others extremely rapid in their progress, and destructive in their effects, could be detailed; and their sources might admit of various conjectures. Most of those which attack the larger and more important animals, bear a strong resemblance to the plague among mankind; they have been traced, in some instances at least, to putrid miasmata, which, if not the origin of such a terrible malady, unquestionably foster its germs, and they are more destructive in all regions during the same period that the plague is most fatal. Probably some animals are exclusively the victims of certain epizooties, while others, that is those of different genera, may escape unhurt; but it is to be doubted, whether any races are totally exempt from them. Thus we are told, that the fish of the Lake of Constance perished from a general mortality in 1722. We have seen that many of the feathered tribes occasionally suffer in different countries: infectious disorders, ending in death, frequently prevail among dogs; and a malignant distemper attacked the cats of Westphalia in 1682; while the same creatures were almost totally extirpated from the Faroe islands by an epizooty in 1798. It is not an improbable theory, that entire genera of animals, once inhabiting the surface of the earth or the waters, are now extinct from contagious maladies.

See *Philosophical Transactions*, vol. xiii. xxix. xxx. xliii. l. *Memoires de l'Academie Royale* 1748. Lancisi *de peste Bovilla Opera*, tom. ii. Dufot *sur la Maladie Epizootique*. Vicq Dazyr *sur les Epizooties*. Camper *Œuvres*, tom. iii. Paulet *Recherches sur les Maladies Epizootiques*. *Traité de l'Education des Animaux*, p. 131. Landt's *History of the Feroe Islands*, p. 210. Bryant *on the Plagues of Egypt*. (c)

EPOCH. See CHRONOLOGY.

EPPING FOREST. See ESSEX, p. 205, 206.

EPTAMERIDE, or HEPTAMERIS, in Music, is an interval, so named by M. Sauveur, (see *Mem. de l'Acad.* 16mo, 1701, p. 407,) as the 1-301st part of the octave, = 2.0405705552, and its common logarithm is .99899990035, but which is assumed by M. Sauveur in his calculations of musical intervals to be .9989000,0000. in order to have the octave expressed by a sup. log. of 3010000,0000. (ϛ)

EQUAL-BEATING *Concords*, in Music. When two imperfect concords are so adjusted, that their BEATS coincide, (see that article,) or an equal number may be counted in a given time in each, they are said to be equal-beating. Dr Robert Smith was the first who gave the theory of beats, or applied them in the way now under consideration, as far as concerned the equal-beating of concords of different kinds to the same base, as IIIds beating *sharp*, and the Vths *flat*; the Vths *flat*, and the VIths *sharp*; and the IIIds *flat*, and the VIths equally *sharp*. See his *Harmonics*, 2d edit. pp. 211—220.*

But Earl Stanhope in 1806, was the first we believe who proposed to use a succession of equal-beating concords of the same kind, in the tuning of musical instruments. A controversy on this subject, which ensued in the *Philosophical Magazine*, to which we have alluded in our article BI-EQUAL *Third*, gave an interest to this latter species of equal-beating concords, which led to the discovery of some beautiful theorems relating to them by Mr John Farey, and we are happy in having it in our power now to lay them before the public for the first time.

Any number of tempered concords of the same name and kind, *i. e.* all flattened or all sharpened, may be so tuned above each other, and *beat equally quick*, that the compass or interval of the whole, or the lowest and highest sounds, may be given ones; for put

t = the number of equal-beating concords to be tuned;
$\frac{n}{m}$ = the ratio of each of these concords when *perfect*;
b = the number of *beats* in 1″ of time;
$\frac{r}{s}$ = the ratio of the given interval or compass; and
N = the number of complete vibrations in 1″, made by the lowest given sound thereof; and we have

THEOREM I.

$$b=\frac{N\times\left(\frac{s}{r}n^t-m^t\right)}{m^{t-1}+m^{t-2}n+m^{t-3}n^2+\ \&c.}$$

the series terminating, when the index of m becomes negative, n and r being the least terms (in their lowest terms) of the ratios, and accordingly as b is positive or negative the beatings will be *sharp* or *flat*.

Also, if V = the number of complete *vibrations* in 1″ of the note arrived at, after tuning t of such equal-beating concords in succession: then,

THEOREM II.

$$V=\frac{(Nm^t\pm b\times(m^{t-1}+m^{t-2}n+m^{t-3}n^2+\ \&c.}{n^t}$$

the upper or lower sign being used, according as b is positive or negative, or the concords greater or less than perfect.

And if $\frac{c}{d}$ = the ratio of the last or uppermost of t, of such equal-beating concords in succession, then

THEOREM III.

$$\frac{c}{d}=\frac{n+(Nm^{t-1}\pm b\times)m^{t-2}+m^{t-3}n+m^{t-4}n^2+\&c.)}{(Nm^t\pm b\times(m^{t-1}+m^{t-2}n+m^{t-3}n^2+\ \&c.)}$$

Example 1. If Earl Stanhope's two equal-beating bi-equal major thirds E♭A and ♭Ac, are to be tuned in the minor sixth Ec, in the octave above tenor cliff C, we have, in Theorem I. $t=2$, $\frac{n}{m}=\frac{4}{5}-\frac{r}{s}=\frac{5}{8}$ and $N=300$,

and $b=\frac{300\times\left(\frac{8}{5}\times16-25\right)}{4+5}, =\frac{300\times.6}{9}=20$, the number of beats *sharp*, made in 1″ by each of these new thirds, as observed in the *Phil. Mag.* vol. xxx. p. 4, and in our article CONCERT *Pitch*. In order to find the vi-

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* Dr Smith shews also, page 93, that in an octave,

$$\text{Every tempered}\left\{\begin{array}{ll}\text{4th,} & \text{and the V. above it,}\\ \text{3d,} & \text{VI.}\\ \text{6th,} & \text{III.}\end{array}\right\}\text{beat equally quick, but contrary, i. e. \textit{flat} and \textit{sharp}, or \textit{vice versa}.}$$

$$\text{Every tempered}\left\{\begin{array}{l}\text{V.}\\ \text{VI.}\\ \text{III.}\end{array}\right\}\text{beats \textit{half as fast}, and contrary, as the}\left\{\begin{array}{l}\text{4th}\\ \text{3d}\\ \text{6th}\end{array}\right\}\text{above it.}$$

brations and ratio of the intermediate note ♭A, we have in Theorem II. $t=1, b=+20$, and the rest as before; and $V=\frac{300\times5+20\times(1+0)}{4},=\frac{1500-20}{16}=380$, the vibrations of ♭A; and $\frac{300}{380}=\frac{15}{19}$ is the ratio of E♭A. And in order to obtain the ratios of these bi-equal thirds, we have in Theorem III. first, $t=1$, $b=20$, &c. and $\frac{c}{d}=\frac{4\times(300+0)}{5\times300+20},=\frac{1200}{1520},=\frac{15}{19}=$E♭A, as before; and second, $t=2$, &c. and $\frac{c}{d}=\frac{4\times(300\times5+20)}{300\times25+20\times(5+4)}=\frac{4\times1520}{7500+180}=\frac{19}{24}=$♭A*c*. Or these same ratios might have been got, by inverting the vibrations of the notes already found: thus, $\frac{300}{380}=\frac{15}{19}$; also $300\times\frac{8}{5}=480$, the vib. of *c*, and $\frac{380}{480}=\frac{19}{24}$, which, as before, are his Lordship's two new thirds, mentioned in our article Bi-equal *Third*. The minor sixth C♭A is $=\frac{12}{19}$.

Example 2. If it be required to tune his Lordship's three equal-beating Tri-equal *Quints*, in the major thirteenth G*e*, (in the middle septave, and partly above and below it,) we have, $t=3$, $\frac{n}{m}=\frac{2}{3}$, $\frac{r}{s}=\frac{3}{10}$, and N = 180; and Theorem I. gives $b=\frac{180\times\left(\frac{10}{3}\times8-27\right)}{9+6+4}=-\frac{60}{19}$, or 3.1578947 *flat* beats per 1″, yielded by each of these three consecutive fifths. See *Phil. Mag.* vol. xxvii. p. 13. In Theorem II. make $t=1$, $b=-\frac{60}{19}$, and the rest as before, and $V=\frac{180\times3-\frac{60}{19}\times(1+0)}{2}=\frac{5100}{19}=268.4210526$ vibrations per 1″ of the note D. See *Phil. Mag.* vol. xxx. page 5. In like manner, when $t=2$, we get $\frac{7620}{19}=401{\cdot}0526316$ vibrations of the note A. If the value of these three tri-equal quints be required, they may be had from Theorem III.; or from their vibrations thus, $\frac{180\times19}{5100}=\frac{57}{85}=$GD; also $\frac{5100}{7620}=\frac{85}{127}=$DA; and the vibrations of *e* being $\frac{10\times180}{3}=600$, we have $\frac{7620}{19\times600}=\frac{127}{190}$ =vib. of A*e*.

Example 3. If three equal-beating *major thirds* be required to be tuned in an octave above tenor-cliff C, we have, $t=3$, $\frac{n}{m}=\frac{4}{5}$, $\frac{r}{s}=\frac{1}{2}$, and N = 240, which in our 1st Theorem gives $b=\frac{240\times\left(\frac{2}{1}\times64-125\right)}{25+20+16}=\frac{720}{61}=11.80328$ times *sharp*, the rate of each of their beating. In Theorem II. $t=1$, &c. and $V=\frac{240\times5+\frac{720}{61}}{4}=\frac{18480}{61}=302.95082$, the vib. of E; and 2d, when $t=2$, &c. $V=\frac{23280}{61}=381.63934$, those of ♭A. The ratios of these two notes will be found $\frac{61}{77}$ and $\frac{61}{97}$ respectively; and the values of these three new thirds come out, CE$=\frac{61}{77}$ E♭A $=\frac{77}{97}$ and ♭A*c*$=\frac{97}{122}$.

Example 4. If four equal-beating *minor thirds* be wanted in the octave as above, we have $t=4$, $\frac{n}{m}=\frac{5}{6}$, $\frac{r}{s}=\frac{1}{2}$, and N=240; and $b=\frac{240\times\left(\frac{2}{1}\times625-1296\right)}{216+180+150+125}=-\frac{11040}{671},=16.45305$ beats *flat* per 1″; and putting $t=1$, &c. in Theorem II. we have $V=\frac{191040}{671}=$ 284.70939 vibrations of ♭E; also by making $t=2$, and $t=3$, we get $\frac{227040}{671}=338.36066=$♭G, and $\frac{270240}{671}=402.74217=$A vibrations. The notes themselves will be found ♭E $\frac{671}{796}$, ♭G$=\frac{61}{86}$, and A$=\frac{671}{1126}$; and the four equal-beating minor thirds will be as follows, viz. C♭E $=\frac{671}{796}$, ♭E♭G$=\frac{796}{946}$, ♭G A$=\frac{473}{563}$ and A*c*$=\frac{563}{671}$. If, in order further to exemplify the use of our 3d Theorem in finding the last of these thirds, we put $t=4$, $b=\frac{11040}{671}$, &c. we have

$$\frac{c}{d}=\frac{5\times\left(240\times216-\frac{11040}{671}\times(36+30+25)\right)}{240\times1296-\frac{11040}{671}\times(216+180+150+125)}$$

$=\frac{563}{671}=$A*c*, as before.

Example 5. Suppose it were required to calculate how many beats must be given to each of 12 successive *fifths* within 7 octaves above tenor cliff C, we have $t=12$, $\frac{n}{m}=\frac{2}{3}$, $\frac{r}{s}=\frac{1}{128}$, and N=240; and in the 1st Theorem we find $b=\frac{240\times(128\times4096-531441)}{177147+118098+78732+\text{, \&c.}}=-\frac{343344}{105459}=-3.2554021$, the *flat* beats per 1″ of each of these duodeci-equal quints. Make $t=1$, &c. and, in Theorem II. we have,

$$V=\frac{240\times3-\frac{343344}{105469}}{2}=\frac{37797168}{105469},=358.3722989,$$

the vibrations of G; and by next making $t=2$, we get $V=\frac{565204080}{105469}=535.9307474$, the vib. of *d*; and thus by taking new values of *t*, all the other notes of such a system may readily be found, and the ratio of each fifth.

In a letter (which the writer has before him) from

Mr Thomas Elliot, organ-builder and tuner, of Tottenham Court, London, addressed to Dr Callcott, in 1807, respecting his attempts to tune Earl Stanhope's system, Mr Elliot proposes, as another mode of tuning, to adjust four equal-beating fifths in a true major third (and two octaves follow in the process) above tenor-cliff C; thus, CG, gD, DA, and aE. This falling of octaves, as it becomes necessary in order to keep within the octave selected for the "foundation," as it is called, might be introduced into our general Theorems above, but would too much complicate them. A less general method has therefore been used in finding the following, viz. Mr Elliot's quadri-equal quints must each beat *flat* 2.016806 times per 1″; and G will vibrate 358.991597 times, D=268.235294, and A=401.344589 times per second.

Earl Stanhope, in the controversy above alluded to, has mentioned another species of equal-beating concords requiring three notes to be sounded at the same time, forming two tempered concords; his two bi-equal thirds, for instance, between the notes E, ♭A and *c*, so adjusted, that there shall be *no beatings between the two beatings*; that is, that the beatings of E♭A and ♭A*c* shall either be exactly *equal*, (as in our first example,) or one be exactly some *concordant multiple*, as 2, 4, 8, &c. or $\frac{3}{2}$, $\frac{4}{3}$, $\frac{5}{3}$, $\frac{5}{4}$, $\frac{6}{5}$, or $\frac{8}{5}$, of the other, in a given time. See the *Philosophical Magazine*, vol. xxxiii. p. 297. (*ℓ*)

EQUAL HARMONY, has, by one class of musical writers, as Mr Emerson, Mr Cavallo, Mr Chambers, &c. been applied to the equalization of the harmony of the 12 keys, or systems of eight notes, above every finger-key of the organ or piano-forte, considered as a key-note; which system is, however, more commonly, and ought always to be denominated, the *equal temperament*, or ISOTONIC system, and by another and more correct class of writers, as Dr Robert Smith, Dr Robison, &c. the term *equal harmony*, has been restricted to the attempt, to attemper the scale so, that *all the concords*, (except the unisons and octaves, which are kept *perfect*,) may be *equally and the most harmonious*, within a given compass of notes.

Dr Smith, in his valuable *Harmonics*, a work undeserving of the censures that have been heaped upon it, has endeavoured to lay the foundation for such a system as has been last mentioned, on his important investigations of the theory of short cycles and *beats*, and, by means of which, this author concludes, (pp. 118. 259 and 263,) that pairs of "imperfect consonances are *equally harmonious*, when their temperaments have the inverse ratio of the (respective) products of the terms of (each of) the perfect ratios of the corresponding perfect consonances." And, by help of arithmetical and harmonical mean proportionals, among the several temperaments of such pairs of consonances, collected in those several parcels, composed of Vths, VIths, and IIIds, and their compliments to, and compounds with VIIIths, Dr Smith's investigations lead to the conclusions, that

A system of equal-harmony, in *one octave*, must have its concords V, VI, and III, tempered, ※ (or +,) or ♭ (or —,) in parts of a major comma, or nearly as follows; viz.

$$\frac{-101}{360},\quad \frac{+57}{360},\quad \frac{-44}{360};$$

or those tempered concords, are V—3.08832Σ, VI+1.74290Σ, and III—1.34542Σ.

In *two octaves*, the same will be very nearly

$$\frac{-9}{32},\quad \frac{+5}{32},\quad \frac{-4}{32};$$

or V—3.09596Σ, VI+1.71998Σ, and III—1.37598Σ.

In *three octaves*, these temperaments will be very nearly

$$\frac{-5}{18},\quad \frac{+3}{18},\quad \frac{-2}{18};$$

or V—3.057742Σ, VI+1.834643Σ, and III—1.223099Σ, and,

In *four octaves*, the temperaments will be nearly

$$\frac{-11}{40},\quad \frac{+7}{40},\quad \frac{-4}{40};$$

or V—3.027162Σ, VI+1.926376Σ, and III—1.100786Σ.

For various reasons, Dr Smith preferred his three-octave system to any of the others; and in his work will be found ample *tables of beats*, and directions for correctly tuning it, upon a proper instrument having 21 strings, at least in each octave, such as he contrived for the purpose; and since then the patent piano fortes and organs of Mr David Loeschman, having 24 sounds in the octave, can, with still greater facility, be used for this purpose; and, indeed, such improved instruments are necessary for giving correct effect to any system of temperament, except the isotonic, to which alone the defective instruments in common use, having only 12 sounds, are correctly applicable.

Dr Smith shews, that his system of equal harmony in three octaves, when tempered as above, has very nearly an equality of beating ♭ and ※, between the Vths and the VIths to the same base respectively; he also mentions, at page 220, that the same differs but little from a system wherein the major third, and the major sixth are *equal-beating* to the same base, the former ♭ and the latter ※. Mr Farey has shewn in the *Phil. Mag.* vol. xxxvi. p. 51, that the temperaments in this case, by ultimate ratios, are

$$\frac{-2}{7},\quad \frac{+1}{7},\quad \frac{-1}{7};$$

or V—3.145104Σ, VI+1.572552Σ, and III—1.572552Σ.

The Doctor likewise shews, that a system, (previously proposed by M. Henfling,) wherein the mean tone is to the major limma as 8 : 5, or the octave is divided into 50 equal parts, approaches very near to his favourite system of equal harmony, stating its temperaments (p. 157) at

$$\frac{-41}{148},\quad \frac{+25}{148},\quad \frac{-16}{148};$$

which are equivalent to V—3.049475Σ, VI+1.859437Σ, and III—1.190038Σ.

All these various systems treated of by Dr Smith, having their temperaments expressed in decimal parts of the schisma Σ, will enable the reader to compare them readily, and calculate their beats by the 5th method, in p. 370 of our third volume. (*ℓ*)

EQUAL TEMPERAMENT, is applied to a system of intervals, wherein each concord, throughout the scale, is alike tempered, and wherein there are twelve semitones, precisely equal; and thence it is called the ISOTONIC *System*; each of which semitones are = 51Σ + f + $4\frac{5}{12}$m, and their ratio the 12th root of ½, which therefore is surd or incommensurate. But Mr Farey has shewn, that a commensurate system, seven of whose half tones are of the value 51 Σ+f+4 m, and five of them of the value 51 Σ+f+5m; also, eleven of whose fifths are of the value 357 Σ+f+31m; and one of the value 357 Σ+f+30m, differing at the most

Equal | Erasmus.

only m. in each case, or less than the $\frac{1}{1200}$th part of a major comma! and yet this temperament, so perfectly equal as to any practical discovery of the error, in the use of it, may be tuned throughout, by perfect intervals, that is, *true* fifths, fourths, and thirds, properly combined. See Farey's *Temperaments.* (ϱ)

EQUAL Altitudes. See Astronomy. p. 654, 798, 830.

EQUATION of Time. See Astronomy. p. 652, 797.

EQUATIONS. See Algebra.

EQUATOR. See Astronomy and Geography.

EQUATORIAL Instruments. See Observatory.

EQUINOCTIAL. See Astronomy and Geography.

EQUINOXES, Precession of. See Astronomy, p. 712, 714.

EQUISETUM. See Filices.

ERANTHEMUM. See Botany, p. 85.

ERASMUS, or Desiderius,* one of the most celebrated scholars of his age, was born at Rotterdam on the 28th of October 1467; and though doomed to struggle, from his birth, with all the disadvantages of poverty and obscurity, yet, by the sole aid of his talents and application, he acquired the favour and protection of the most distinguished personages of that eventful period in which he lived. He was the natural son of Gerard, a native of Tergou, by Margaret, the daughter of a physician in Sevenbergen, whom his father intended to marry; but, being deceived by a report of her death, he became disgusted with the world, and took orders in the church. When little more than four years of age, Erasmus was so remarkable for his musical voice, that he acted as chorister in the cathedral of Utrecht; and when he had attained his ninth year, he was sent to a school at Daventer, where he made great progress in learning, and possessed so excellent a memory, that he was able to repeat the greater part of Terence and Horace. At thirteen years of age, he was deprived of both his parents; and his guardians, with a view to embezzle his little patrimony, forced him into a monastery. His constitution, which was naturally delicate, rendering him unable to bear the watchings and other austerities of the monastic life, and his whole sentiments and temper being equally averse from the habits of the profession, he accepted, in his 23d year, an invitation from Henry a Borgis, Bishop of Cambray, in whose family he admits that he wanted for nothing, but from whose patronage he derived very little assistance. In 1496, he went to study at Paris, where he supported himself by instructing a few pupils in private, and where the literary exertions, to which he was compelled by his necessities, greatly contributed to his future eminence. By the friendship of some of his pupils, who were the sons of Englishmen, and particularly of William Lord Mountjoy, who afterwards allowed him an annual pension of a hundred crowns, he visited England in 1497, and formed an acquaintance with the most eminent literary characters of that country. During the succeeding ten years, he seems to have frequently changed his place of residence, and to have visited various parts of France, England, and the Low Countries. He was most stationary, however, in Paris, where he employed himself in the study of the Greek language, and in the composition of his early publications. He complains, in his epistles, that want of money prevented him, about this time, from finishing many of his treatises, and compelled him to spend much of his time in reading lectures to young students. He received, however, frequent donations from his friends and patrons, particularly from Anne Bersala, Marchioness of Ure, whom he often addressed in letters of the most complimentary style, and to whom he made known his pecuniary wants with very little delicacy. About the beginning of the year 1507, he went to Italy, in order to take a doctor's degree, which, he observes, "makes one neither better nor wiser, but must be done, if a man would be esteemed by the world." Having resided about a year in Florence, he proceeded to Venice, where he published a third edition of his Adages; and, after spending a short time at Padua, he arrived in Rome in 1509. At this time, he was acting as tutor, to Alexander, Archbishop of St Andrews, natural son of James IV., of whom he draws a very high character, and who was afterwards slain, with his father, at the battle of Flodden Field. At Rome, he at first experienced the most flattering attentions, and received several advantageous offers to induce him to settle in that capital; but at length he seems to have questioned the sincerity of his Italian friends, and, in his "Praise of Folly," which he wrote soon after, expressly complains of the neglect with which he was treated by the papal court. He gladly accepted, therefore, the invitations of Henry VIII. and of his former pupil, Lord Mountjoy, to return to England, where he continued a considerable time in great favour with the King, with Wolsey, with Warkam Archbishop of Canterbury, with Sir Thomas More, and many other nobles and prelates of distinction. Invited to Cambridge by Fisher, Bishop of Rochester, he was promoted successively to the divinity and to the Greek professorship; and continued to teach publicly in that university for the space of four years. Though he received many valuable donations, and derived several small annual pensions from the liberality of his patrons, or from the livings with which he was presented, he was always in poverty, and always importuning his friends for pecuniary assistance. Either from want of economy, or from the infirm state of his health, which required many indulgences, or from his satirical disposition, which alienated the affections of his admirers, he found himself unable to subsist in England; and, in 1514, he removed to Germany, where he was appointed nominal counsellor to Charles, Archduke of Austria, with an annual stipend of 200 florins. From the period of his publishing the "Praise of Folly," he was no longer considered as a true son of the church; and his incessant invectives against the monastic orders, drew upon him the bitterest persecutions from that quarter. In order to shelter himself from their slanders and machinations, he petitioned and procured from Pope Leo X. a dispensation, in due form, from the vow which he had reluctantly made in his youth among the regular canons. In 1516, he published, and dedicated to Leo his edition of the New Testament in Greek and Latin, with notes, a work which had long occupied his chief attention, and which, while it drew upon him the censures of ignorant and envious critics, was highly valued by all who were capable of appreciating its merits. About the same time he produced, and inscribed to Archbishop Warkam, an edition of the works of Jerome, whom he professed, in rather exaggerated terms, to hold in the greatest estimation, as an author and a

Erasmus.

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* His original name was Gerard, signifying "amiable," which, according to the custom of the times, he rendered into the Latin epithet *Desiderius*, and the Greek *Erasmus*, or rather, as he afterwards wished to have expressed it, *Erasmius*.

theologian. He received the most pressing invitations from Francis I. to settle in his dominions; but dreading the envy of the French literati, and the persecutions of the Doctors of the Sorbonne, and being unwilling to forsake possessions for promises, he retained his preferments under the Emperor. In 1517, he revisited England, and was very courteously received by the king and by Cardinal Wolsey; but, though he declined their offers to provide for him in that kingdom, he mentioned to one of his friends, that his English revenues constituted his chief support. In the same year he published a work entitled *Querela Pacis*, in which, with much soundness of reasoning, power of eloquence, and freedom of sentiment, he expostulates with the sovereigns of the world upon the atrocities of war, and pronounces all hostilities which are not strictly defensive, to be unlawful and unchristian. A benevolent project for a congress of princes at Cambray, who should enter into mutual engagements for the preservation of peace, having been unhappily thwarted by the arts of interested persons, Erasmus wrote his "Complaint of Peace," at the request of John Sylvagius, Chancellor of Burgundy, who had been a zealous promoter of the plan. (The work was dedicated to Philip of Burgundy, Archbishop of Utrecht, who expressed his approbation, by offering the author a benefice, and presenting him with a valuable sapphire ring, which he requested him to wear for his sake.) During the six succeeding years, he resided chiefly at Louvain; and, by the commencement of the Reformation under Luther, was involved in new difficulties and disputes. Hitherto, he had often experienced the enmity of the scholastic divines, and of the monastic orders, of whose absurdities and immoralities he had so openly assailed in his writings; but he found no difficulty in parrying their attacks, and preserving the favour of the most zealous Catholic princes and prelates. But, as the struggles between the Romanists and the Reformers became more serious, it required his utmost exertion of ingenuity and caution to preserve at once consistency of sentiment, and security from persecution. Both in conversation, and from the press, he had been accustomed to inveigh against many of those errors in doctrine, and superstitions in worship, which disgraced the church of Rome. Some of these he ably confuted by the utmost solidity of argument and force of eloquence; while he directed against others those weapons of ridicule and sarcasm, which he was able to wield with such irresistible effect. Nor did he spare even the character of the ecclesiastics; but, with the greatest ability and most exquisite raillery, exposed to the world their spiritual domination, their impious frauds, their ambition, avarice, and luxurious excesses. Scarcely did one of those opinions and practices, which Luther afterwards attempted to reform, escape the animadversions of his pen; and, as his writings were read with universal admiration, they contributed, in no small degree, to the progress of the Reformation: "Luther," it was said, "hatched the egg, which Erasmus had laid." Nor was he merely the forerunner of the great reformer; but, for some time after Luther had commenced his career, he acted as his admirer and auxiliary; applauded his conduct, and expressed hopes of his success; recommended moderation in his measures, but encouraged him to proceed; vindicated his character to the dignitaries of the church, condemned the spirit of his adversaries, and always insisted that his books should be answered by reasoning, instead of being suppressed by authority. In several of his publications, he openly concurred with him in denouncing the obscure and unedifying systems of the school divines, and calling the attention of mankind to the study of the Sacred Scriptures, as the only standard of religious truth. In his celebrated "Colloquies," particularly, which he published in 1522, he directs his severest strokes against the monks and their superstitions; and so manifest was its reforming tendency, that the Faculty of Theology at Paris, and afterwards a provincial council at Cologne, denounced it as "a wicked book, the perusal of which should be forbidden to all, especially to the young, and which ought, if possible, to be entirely suppressed." But, though he entertained so great a similarity of sentiment with the reformers, he was prevented, by a variety of circumstances, from decidedly espousing their cause. His extreme love of peace rendered him averse from those measures of direct opposition to the church, which had become necessary, and flattered him with the delusive hope of a gradual reformation by gentler methods. His excessive deference for persons of high station, his intimate acquaintance with the more learned ecclesiastics, and his love of the literary reputation which he had acquired among them, kept him from embracing a party, to which his patrons and friends were personally adverse. His dread of losing the pensions and other emoluments, which he derived from the Catholic princes and prelates, may be supposed to have had a considerable influence upon his conduct. His natural timidity of mind, particularly disqualified him for encountering persecution; and, by his own confession, would have induced him to consult his personal safety, however much he had approved the sentiments and measures of the reformers. "It is true," he writes to his friend Richard Pace, dean of St Paul's, "Luther hath given us many a wholesome doctrine, and many a good counsel; and I wish he had not defeated the effect of them by his intolerable faults. But, had he written any thing in the most unexceptionable manner, I had no inclination to die for the sake of truth. Every man hath not the courage requisite to make a martyr; and I am afraid, were I put to the trial, I should imitate St Peter." There is no reason, indeed, to suppose, that those motives, powerful as must have been their influence upon such a feeble temper as he possessed, engaged him either to act or write in direct opposition to his conscience; but they may have biassed his judgment, while he was unconscious of their operation, and may serve to palliate, while they cannot excuse, the unworthy concealment and concession of his opinions, by which he endeavoured to ensure his tranquillity. While he embraced every opportunity, in his epistles, to disclaim all connection with Luther, he was equally anxious to evade the repeated attempts which were made to engage him in a controversy with the reformer; and, on one occasion, when exhorted by Mountjoy, to repel the accusations of heresy with which he was assailed, by taking up his pen in defence of the church, he frankly replied, "Nothing is more easy than to call Luther a blockhead; nothing less easy than to prove him one; at least so it seems to me." At length, partly irritated by the reproaches of the more zealous reformers, and partly apprehensive of incurring the displeasure of the court of Rome, he proceeded first to repress his own zeal against the abuses in the church; then to assume the character of a mediator between the contending parties; then to censure the impetuosity of Luther's proceedings; and finally, to enter the lists as his antagonist.

Upon a rumour probably of his intention to attack the reformers from the press, Luther addressed him in a letter, full of spirit, yet expressed with much apostolical dignity, in which he reminds him of his weakness, and exhorts him to continue to be a spectator rather than an actor in the contest: "We saw the Lord had not conferred on you the decernment and resolution to join us, and openly expose those monsters; therefore dared not exact from you what greatly surpasseth your strength and capacity. We have even borne with your weakness, and honoured that portion of the gift of God which is in you." "On the other hand, my dear Erasmus, if you duly reflect on your own imbecility, you will abstain from these sharp and spiteful figures of rhetoric; and if you cannot or will not defend our sentiments, you will let them alone, and treat of subjects which suit you better." In 1525, however, Erasmus commenced open hostilities, by publishing his *Diatribe de libero Arbitrio*, in which he merely opposes the opinions of Luther on Predestination; a subject, which he seems to have purposely selected, as it furnished the appearance of dissenting from the reformer, while it was altogether unconnected with his more obnoxious tenets; and in the discussion of which, he was in fact led to controvert the sentiments of St Augustine and of Thomas Aquinas, as much as those of the German divine. In a letter to Melancthon, he makes an apology for this publication, alleging in his defence, that the calumnies of the ecclesiastics, who made him pass for a Lutheran, and the importunity of princes, whose authority he could not disregard, had constrained him to write; and intimating at the same time, as a farther proof of his general good will, that he had employed all his influence to prevent the exercise of cruelty towards the reformers. Luther replied in a treatise, entitled *De servo Arbitrio*, in which he appears greatly superior to his opponent in the knowledge of the subject, and the management of the argument; but treats him throughout with very little courtesy, which, indeed, he had not much title to expect; and assails him with a mingled volley of compliment and scorn, of commendation and invective. Erasmus renewed the controversy, by publishing his *Hyperaspistes*, and the dispute was carried on with augmented and unjustifiable acrimony on both sides. After the year 1523, Erasmus resided several years at Basle, a place to which he was much attached, and which his enemies used to call his city of refuge. He was made rector of the university, and being surrounded by friends in whom he could confide, he found himself more secure from injury among the reformed divines of that city, than among the Romish monks and ecclesiastics. But when the Protestants gained the ascendancy in the revolution which took place there in 1529, he became apprehensive of being suspected as their coadjutor should he continue among them, and removed to Friburg. In the course of the year preceding his removal, he published two treatises in the form of dialogue; one of which, the most learned of all his writings, discusses "the right pronunciation of the Greek and Latin languages;" and in the other, entitled *Ciceronianus*, he rallies, with great ingenuity and sprightliness, the servile followers of Cicero, who scrupled to employ any word or phrase which was not to be found in his works. This latter production drew upon him much odium from many of his learned contemporaries, whose sentiments he controverted, or whose merits he had failed to praise, according to their expectations; and particularly from Julius Scaliger, who published two orations against him so full of bitterness and scurrility, that his own friends expressed their dissatisfaction, and prevailed upon him, after the death of Erasmus, to do justice to his memory. As Erasmus advanced in life, he lost much of that openness and candour which had distinguished his early years; and so anxious did he become to disclaim the cause of the reformers, that, besides dissembling, he proceeded to contradict his most avowed sentiments. He had always professed his abhorrence of every thing like cruelty in the measures which were adopted for suppressing the principles of the Reformation; but, when some of the Protestants began to produce passages from his writings, which seemed to favour their cause, and particularly to deny the lawfulness of putting heretics to death, he was so fearful of being suspected by the persecuting princes of his day of condemning their barbarous doings, that he published a letter "against some who falsely call themselves Evangelics," in which he maintains, with unusual acrimony, that there were certain heretics, who might lawfully be put to death, as guilty of blasphemy and sedition. These unworthy concessions on his part were duly appreciated by the court of Rome; and, as he was now the declared defender of the church, it was resolved to prepare him for receiving a seat in the College of Cardinals; but these rewards came too late, and his increasing infirmities obliged him to decline the preferments which were offered to him in that view. In 1535, he went to Basle, in order to superintend the printing of his *Ecclesiastes*, and in the hope of recovering his lost health; but his strength continued rapidly to decline, and he died of a dysentery on the 12th day of July 1536, in the 69th year of his age. He was buried with great funeral pomp in the cathedral church of Basle, where his tomb still remains, and where his cabinet, containing his ring, seal, pencil, knife, sword, portrait, and the New Testament written by his own hand, is exhibited to strangers, as one of the greatest curiosities in the city. His memory is equally honoured at Rotterdam, by an inscription upon the house in which he was born, and upon the college which bears his name; and by a bronze statue in the great square. By his will, he left handsome legacies to several of his friends, and directed the remainder of his property to be applied to charitable purposes; by which it appears that he was neither so straitened in his circumstances, nor so defective in economy, as he was accustomed to represent himself. He is said to have left more than 7000 ducats. Erasmus was rather of low stature, but well formed, of a fair complexion, with grey eyes, a cheerful countenance, a low voice, and agreeable elocution. His bodily constitution was very infirm; and, among other peculiarities, he was not able to endure even the smell of fish, which made it necessary for him to procure a dispensation for using other food in Lent, and which gave him occasion to say of himself, that however friendly to the church in principle, he had a most Lutheran stomach. He was always neat in his apparel, facetious in his disposition, and fond of a witty story though directed against himself. He used to dine late, that he might have a long morning for study; but after dinner, he conversed cheerfully with his friends on any subject, and delivered his opinions both on men and things with the greatest freedom. In his intellectual character, he was distinguished by a strong memory, extensive reading, a penetrating genius, and a lively imagination. He composed with great facility, but disliked the task of revising his writings. His prose style in Latin, (the language to which he chiefly devoted his attention,) though not always classically pure, is uniformly unaffected, clear, and copious; but his verses in that language, though sufficiently correct in point of prosody, and distinguished by good sense, discover little elegance of taste, or poetical talent. He was constant and faithful to his friends, but too apt to trouble them with complaints against his adversaries; and, though generous and charitable to those who were poorer than himself, he was not very delicate in soliciting and accepting pecuniary donations from his patrons. With all the allowances which can be fairly made for his prejudices of education, his love of peace, and his reluctance to offend his best friends, he cannot be acquitted of timidity, lukewarmness, dissimulation, and a partial desertion of principle in the business of the Reformation; but he spent a long life in opposing ignorance and superstition, and promoting the interests of sound literature and true piety; and, with all his failings, he must unquestionably be regarded as one of the principal ornaments of the age in which he lived. His works, which were very voluminous, consist of translations from the Greek; grammatical and philological dissertations; various treatises on moral and religious topics; a version of the New Testament; paraphrases and commentaries on several parts of sacred scripture; apologies, epistles, declamations, orations, poems, adages, apophthegms, editions of celebrated authors, &c. His paraphrases were the most favourably received of his theological productions; and his colloquies, and praise of folly, have been the most frequently printed of all his writings. The best and most elegant edition of his works is that published in Holland by Le Clerc, in eleven volumes folio, 1703. See Jortin's *Life of Erasmus*; Bayle's *Dictionary*; *General Biographical Dictionary*; Robertson's *History of Charles V.* vol. ii. p. 156; Le Clerc's *Bibl. Univ.* tom. viii. p. 215; Milner's *Church Hist.* vol. iv. App. p. xvi. and pp. 845, 943, 1060. (*q*)

EREMOPHILA. See Botany, p. 258.

ERFURTH, Erfort, or Erfurt, formerly *Erpes*, or *Erpis*, is an ancient town of Germany, pleasantly situated on the river Gera, which flows through the town in numerous branches. Although the town is in general ill built, yet it possesses several public buildings of importance. The cathedral, which was built in 752, contains a huge bell, which weighs 30,250 pounds. In the cidevant convent of the Bernardins, is shewn the tomb of the famous bigamist, the Count of Gleichen, who is said to have been interred there beside his two wives. The university of Erfurth was established in 1392, and half of the chairs were filled by Catholics, and the other half by Protestants. In 1754, the Academy of Sciences was founded, which was subsequently enlarged by the addition of a botanical garden, an anatomical theatre, an observatory, a riding school, and a society of natural history. The principal public libraries are those of the University, of the Academy of Physics, of the Scottish Benedictines, and of the Lutheran ministry. The library of the Scottish Benedictines possesses a cabinet of physical and mathematical instruments; and that of the Lutheran ministry contained some ancient MSS. of the Hebrew Bible. The house for the orphans of Lutherans was formerly the monastery of the Augustins, and contains a cabinet of natural history. Erfurth formerly contained eight monasteries, four Catholic churches, and nine Lutheran churches. The town is defended by the fortress of Petersberg, which was generally considered as a place of strength till the year 1806, when the French entered it without resistance. The country around Erfurth is fertile in corn and vines, and abounds in bastard saffron and anise, which the inhabitants cultivate with great care. Almost every house in the town has a garden, hence the number of gardens amounts to about 1200.

A variety of manufactures are carried on at Erfurth, but the principal ones are those of woollen stuffs, leather, and ribbons, the last of which gives employment to 1500 individuals. Population 17,000. Its position, according to trigonometrical observations, is east longitude 11° 2′ 26″, and north latitude 50° 58′ 45″. For an account of the Academy of Erfurth, see our article Academy. See also *Erfurt und das Erfurtische Gebiet*, Vom Prof. Dominicus, Gotha 1793, vol. ii.; and *Erfurt mit seinen Merkwurdigkeiten und Alterthumern*, Vom D. Arnold, Gotha 1802, 8vo. (*w*)

ERIACHNE. See Botany, p. 115.

ERIANTHUS. See Botany, p. 116.

ERIC. See Denmark.

ERICA. See Botany, p. 202.

ERIGERON. See Botany, p. 301.

ERINUS. See Botany, p. 252.

ERIOCAULON. See Botany, p. 109.

ERIOCEPHALUS. See Botany, p. 309.

ERIOCHILUS. See Botany, p. 307.

ERIOGONUM. See Botany, p. 208.

ERIOPHORUM. See Botany, p. 100.

ERIOSPERMUM. See Botany, p. 189.

ERIOSTEMON. See Botany, p. 221.

ERITHALES. See Botany, p. 151.

ERIVAN, Irvan, or Irivan, a town of Armenia, in the Persian empire, and capital of a province of the same name. The province is bounded by the Mosian hills on the north and west, by the Araxes on the south, and by the districts of Karabaug and Karadaug on the east. The town is situated on the banks of the Zengai, in a plain surrounded by mountains. It is defended by a fortress of an elliptical form, and upwards of 6000 yards in circumference. The north-west side of the town stands upon a precipice, about 600 feet high, and impending over a river; but it is commanded by the fort, which is surrounded with two strong walls flanked with towers. The town is large, dirty, and ill built. The churches, which resemble catacombs, are small, and half buried in the ground. There are 28 poorly endowed convents in the town and neighbourhood for both sexes.

Erivan does not at present contain a tenth part of its former population, and it has been reduced by repeated sieges to a ruinous condition. In the year 1808, the Russians under General Godowitch blockaded the town for nearly six months, and at last attempted in vain to carry it by storm. They were repulsed with great slaughter, and nearly half of the army was lost during its retreat to Teflis. The Turks and Persians, however, have repeatedly taken the town; and it has remained in the possession of the latter since the peace of Nadir Shah, in 1748.

About two days journey to the north-east of Erivan, is the beautiful lake which the Persians call Deria Shireen, or Goucheh. It is about five fursungs in circuit, and abounds in trout, and other delicious fish. The Armenian sanctuary of the three churches, which Sir John Chardin has particularly described, is about nine miles from Erivan. At a short distance to the south of the town is the famous mountain of Ararat, where the ark rested after the deluge. According to Major Sutherland, it forms an angle of an immense range of mountains, and has two summits, on the highest of which the natives believe that part of the ark still re-

Erlach
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Eruption.

mains. A chasm of prodigious depth, resembling a crater, exists in one of its sides. It is often covered with smoke, and Dr Reineggs affirms, that during three successive days he saw it discharge fire. The ruins of the once magnificent city of Nuksheevan, or *Naxuana*, are situated about twenty-six fursungs to the south-east of Erivan. It is a heap of rubbish, and does not contain more than 400 inhabitants. The prince of Persia generally pitches his camp here, to direct the operations of the campaign against the Russians. East Long. 45° 15′, and North Lat. 40° 11′. See Chardin's *Travels*. Macdonald Kinneir's *Geographical Memoir of the Persian Empire*, p. 319, 320; and our article Ararat. (*j*)

ERLACH, or Cerlier, is a small town of Switzerland, in the Canton of Berne, beautifully situated at the western extremity of the Lake of Bienne, near the embouchure of the Thiele, and at the foot of the Julimont or Julius's Mountains, upon which one of the strongest entrenched camps of this great warrior was established. The Chateau of Cerlier, situated upon the Julimont, was built about the middle of the 11th century by the Count Bourcard, one of whose brothers founded the convent of St John, situated near the embouchure of the Thiele, and formerly known by the name of the Convent of Erlach. The view of this ancient abbey, and of the bridge over the Thiele, is very picturesque. The Isle of St Pierre, famous for being the residence of Rousseau, is seen from Erlach. See Ebel's *Manuel du Voyageur en Suisse*, tom. iii. p. 565, Zurich, 1810. (*j*)

ERLANGEN, or Erlang, is a handsome town of the kingdom of Bavaria, situated on the river Rednitz. The town is divided into the Old and New. The New Town, which is also called Christian Erlang, was founded in 1686, by the Margrave Christian Ernest, to accommodate the families of several Protestant refugees from France. The streets of both the Old and New Town are regular and spacious, and there are two handsome squares, and some fine churches. The principal public buildings, institutions, &c. in Erlang, are, the Chateau, the buildings of the University, which was transferred from Bayreuth in 1742, the Lutheran church, and the church of the French and Germans, the Institute of Morals and Belles Lettres, the Library and Cabinet of Natural History, belonging to the university; the Academy of Music, and two theatres. The principal manufactures of the town are stockings made in the loom, hats, gloves, and glass, most of which were established by the French refugees. About a league from Streitberg, which is one of the posts on the old road between Erlangen and Bayreuth, is the Grotto of Muggendorf, where there are fine stalactites, and a fall of water 70 feet high. The new road to Bayreuth, passes through Creussen, Pegnitz, Hilpoldstein, and Eschenau. Population 8700. Its position, according to trigonometrical observations, is, East Long. 11° 4′; *North Lat. 49° 35′ 36″*. (*w*)

ERMELAND. See Prussia.

ERNE Lough. See Fermanagh.

ERNODEA. See Botany, p. 121.

ERODIUM. See Botany, p. 265.

EROTEUM. See Botany, p. 235.

EROTYLUS. See Entomology, Index.

ERPETOLOGY. See Herpetology.

ERROMANGO. See New Hebrides.

ERTZGEBIRGE. See Saxony.

ERUPTION. See Ætna, Vesuvius, and Volcanoes.

Eruptive
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Erzeroom.

ERUPTIVE Diseases. See Medicine.

ERVUM. See Botany, p. 284.

ERYCIBE. See Botany, p. 177.

ERYNGIUM. See Botany, p. 161.

ERYSIMUM. See Botany, p. 261.

ERYSIPELAS. See Medicine.

ERYTHRÆA. See Botany, p. 173.

ERYTHRINA. See Botany, p. 274.

ERYTHRONIUM. See Botany, p. 190.

ERYTHROXYLON. See Botany, p. 218.

ERZEROOM, Erzerum, or Arzerum, the name of one of the most considerable of the pachalics of Armenia, and of the principal place of the pachalic. It is said to be divided into 12 districts or sanjeets, governed by a pasha of three tails, who resides at Erzeroom, the capital. This city, known to the Byzantines by the name of Erze, is one of the most populous and flourishing cities in the kingdom, and is situated about three or four miles from one of the streams which runs into the Euphrates. The town is ill built, the streets are very dirty, and the houses are for the most part low, and built of wood. The bazars are large and well supplied with provisions; but fruit is very scarce, as it is all brought by the Georgians from the province of Akisha, which is three or four days journey distant. In 1810 there were nearly 40 mosques, four of which were deemed handsome, a Greek church, a large Arminian chapel, and three celebrated monasteries at some distance from the city.

The town is surrounded with walls, and on the south it is protected by a citadel mounting 20 pieces of cannon of various calibres. On its eastern face it has regular embrasures; but from its want of solidity, it is equally defenceless with the rest of the castle. On the north side of the town is a very high mountain, covered with eternal snow. The plain in front is about 20 miles in circumference, and is adorned with more than 60 villages. In the year 1807, when the French legation under General Gardanne passed through this place, there was on the ramparts a house in ruins, which was used for leprous persons. The plague then raged in the town, carrying off from 20 to 25 persons daily. The principal articles of manufacture in Erzeroom are copper, the ore of which is brought from a place about three days journey from the town, and the skin of a species of martin. Erzeroom is the staple of the merchandise of India, consisting of silk, cotton, painted linens, spices, rhubarb, madder, and zedoary.

The climate of Erzeroom is intensely cold in winter, but the air is salubrious, the water good, and the natives strong and healthy. The winter commences in the month of August, when the snow begins to fall. It continues on the ground from October till March, when it melts, and causes all the rivers in the country to overflow their banks. According to Mr Macdonald Kinneir, the population of the city was about 100,000, of whom 15,000 were Armenians, and the rest Turks, with the exception of 200 or 300 Greeks. The author of the "Journal," who accompanied the French Legation in 1807 and 1808, makes the population 130,000, and says that 500 of these were Armenian catholics.

Erzeroom is five ordinary days journey from the Black Sea, thirteen from Diarbeker, and nine from Bayazid. It is situated in East Long. 40° 57′, and North Lat. 39° 57. See *Journal d'un Voyage dans la Turquie D'Asie, et la Perse, fait en* 1807 *et* 1808, p. 21. Paris 1809; and Macdonald Kinneir's *Geographical Memoir of the Persian Empire*, p. 321, 322. Lond. 1813. (*w*)

ESCALLONIA. See BOTANY, p. 152.

ESCAPE. See FIRE ESCAPE.

ESCAPEMENT. See HOROLOGY, and TIME-KEEPERS.

ESCHATON, an interval in music =—, of Dr Callcott, has a ratio $\frac{16,677,181,699,666,569}{16,777,216,000,000,000}=5\Sigma+2f,=5.299322\Sigma$, and is the *Greater* RESIDUAL. (ϱ)

ESCHATON of *M. Henfling* and *Travers*, is an interval whose ratio is $\frac{390,625}{393,216}=6\Sigma-f+m,=5.858202\Sigma$, and is the *Major* RESIDUAL, (ϱ)

ESCOBEDIA. See BOTANY, p. 258.

ESCULAPIUS. See ÆSCULAPIUS.

ESCURIAL, the name of a village in Spain, about seven leagues from Madrid, and celebrated for the magnificent palace of the Escurial, or St Lorenzo, which has been deemed by the Spaniards the eighth wonder of the world. This splendid structure was begun in 1557, by Philip II. in commemoration of the battle of St Quintin, which he gained on the day of the Spanish saint St Lorenzo, from which it received its name. The first architect was John Baptiste Manegro of Toledo, and upon his death, in 1567, the work was continued by Bustamanti, one of his pupils, who died in 1597.

The building, which consists of grey stone, from the neighbouring quarries, is arranged in the form of a gridiron, in allusion to the martyrdom of St Lorenzo. The dome of the church is surrounded with eight symmetrical towers, which give a fine effect to the whole edifice.

The Escurial is a long parallelogram with four fronts. The principal or north front is 637 feet broad, and 51 high up to the cornice. It is flanked at each angle with a tower 180 feet high. It has three entrances, and 200 windows. The lower part of the central gate is adorned with eight Doric columns, and the upper part with four Ionic columns. The front on the opposite side towards the east, is of equal extent, and is approached by a large square raised on arches like a terrace, and surrounded with a lofty ballustrade. The west and south fronts are of the same dimensions; the latter having five rows of windows, and the former almost none.

This vast building affords accommodation to a community of monks, as well as to the sovereigns of Spain.

The apartments occupied by the monks contain various objects deserving of notice. The chapter room and the prior's apartment, contain many admirable pictures. The old church is 129 feet long, and 33 feet broad. The refectory is 103 feet long, and 33 broad. Among other paintings, is a Lord's Supper by Titian, which is greatly admired. The ground cloister is a square formed by a double row of piazzas, one above the other, 98 feet long on each of the four sides, and 17 feet broad. The walls of the lower cloister are covered with paintings by the first artists. The staircase from the lower to the upper cloister is adorned with fine fresco paintings, one of which represents the foundation of the monastery, and the battle of St Quintin. The upper cloister itself is ornamented with the finest pictures.

The double cloister, which is built of granite, is 52 feet high, and has four grand fronts, one at each side opening on a spacious court of 88 arches, eleven in each row, supported by 96 columns, which are Doric below and Ionic above. The area of the cloister is divided into several compartments. A small octagonal temple about 52 feet high and 26 in diameter, and terminating in a dome, occupies the centre. Without it is built of granite, and within of fine jasper marble; and its eight sides are alternately adorned with projecting columns, or with statues as large as life; all the ornamental sculpture being wrought in Genoa marble.

The libraries are peculiarly valuable and interesting. In one of the libraries is a collection of books in Latin, Hebrew, and Arabic characters, with an assemblage of 4300 MSS. of which 567 are Greek, 67 Hebrew, 1805 Arabic, and 1820 in Latin, Castilian, and other languages. In this number are included several Bibles, particularly the Greek Bible of the Emperor Cantacuzene. There is also in this library a collection of ancient and modern medals. A part of the other library, which is deposited in a private cabinet, contains many choice designs and ancient MSS. Among these is a copy of the Four Evangelists, 700 years old, embellished with miniatures, and also a Greek Liturgy, supposed to have been written by St Basil. The apartment in which these are contained is adorned with fluted Doric columns, and the roof and frieze are covered with allegorical paintings. On a table in the centre, is a small octagonal temple, which represents Charlemagne in the midst of his princes and palatines. The temple is of silver, and is embellished with 20 pounds of lapis lazuli, 48 ounces of gold, and 1448 ounces of silver, besides agates, diamonds, and other precious stones. The monks are extremely attentive in shewing all these curiosities to strangers.

The royal apartments are adorned with the finest paintings, which are displayed in two adjacent galleries. One of these is called the Gallery of the Infanta, and the other, which is the principal one, is 70 feet long, on the walls of which are traced many of the military atchievements of the Spaniards, from which it has received the name of the Battle Hall.

The Campana communicates with the main building by a double gallery, one above the other, 86 feet long, and adorned with Ionic columns. The church is ascended by a fine staircase, 136 feet broad, and 34 long, which leads to a piazza, forming the foreground of the church. This piazza opens to five arcades resting on pilasters, which support Doric semicolumns. Above these is raised a second body, adorned with six statues of the kings of Israel, 18 feet in length, and formed of white marble inlaid with black. This front is flanked by two towers, which are used as belfries. The inside of the church, which is Doric, is in the form of a Greek cross, with a lofty dome in the centre. It is 313 feet long, and 194 broad, and contains 48 altars, enriched by fine paintings. A fine marble statue of St Lorenso is placed over the holy water pot, and is supposed to have been an antique discovered at Rome. The interior of the choir is exquisitely finished, and the fine paintings of Cambiaso cover the walls and ceilings. The pulpit of cedar and ebony, resting on four columns of bronze, is finely ornamented; and there are two rows of stalls, including 228 seats. The chancel, which is raised by 12 steps, is adorned with bronzes, and has fresco paintings on its roof. It contains two mausoleums, one representing the statues of Charles V., his Empress Elisabeth, his daughter the Empress Mary, and his sister the Queen of France and Hungary. The other exhibits the statues of Philip II. and of his three queens, Anne, Mary, and Elisabeth, all of gilt bronze. Three doors, adorned with crystal and bronze, lead under an arch into the chancel, and conduct to three compartments, where the royal family assist at divine service. The principal altar consists of four bodies of architecture. In the first are six Doric columns, in the second six fluted Ionic columns, in the third four fluted Corinthian columns, and in the fourth two Composite ones. Fifteen statues, and several paintings, are attached to these, several of which are very beautiful. The ornaments of the columns and pilasters are of gilt bronze. In the centre of the altar stands a Corinthian circular table; 14 feet 7 inches high, and 6 feet 7 inches in diameter. It is adorned with the statues of the twelve apostles, in gilt bronze, and with eight columns of red jasper marble, which can scarcely be distinguished from agates. This beautiful structure terminates in a dome of jasper marble, which contains a statue of Christ, and is adorned with a topaz as large as the hand, and encased in a rose of gold. Within this tabernacle is inclosed another, more gorgeous and magnificent; it is of a square form, 19 inches high. It is decorated on each side with four columns and four pilasters, having their bases and capitals of gold enamel, and the cornice of silver. It is crowned with small pyramidal spires, placed on pedestals of vermilion stone, embossed with gold. Two doors of rock crystal, studded with gold, appear at the two sides, and the whole, like the larger tabernacle, terminates in a dome, on the top of which is an emerald attached to a rose of gold, and on the inside a beautiful topas inclosed in gold enamel.

The sacristy is included in one beautiful nave, 93 feet long, and 80 feet broad, and is enriched with relics, shrines, chalices, crosses, chandeliers, and paintings of inestimable value. On the altar called Santa Forma, adorned with the finest marble and bronzes, is preserved a splendid tabernacle, presented by the Emperor Leopold.

The treasury of this church contains many articles of great value: among these are a statue of St Lorenzo, which weighs 900 marks of silver, and 36 marks of gold; an allegorical statue of the city of Messina, which bears in its hand an ostensoire of gold, weighing 50 marks; a small temple of gilt bronze, more than 100 feet high, adorned with eight Doric columns, and surmounted with a dome; a crucifix of silver, attached to a cross of gilt silver, having a topaz on the head, a large ruby in each hand, and a brilliant stone, an inch in diameter, at the feet, which was long considered as a diamond.

The place of interment for the royal family of Spain, is called the Pantheon. It is below the church, and is perhaps the most splendid part of the Escurial. The descent is by 59 steps, which form the first staircase. Its walls and arches are encrusted with the finest marble, and it leads to a landing place of a round form, decorated in a similar manner. After continuing to descend some stairs, we discover a beautiful front, formed by 10 marble Doric columns, the ornaments of which are all of gilt bronze. On each side are placed two allegorical statues of bronze, one representing Human Nature, and the other Hope. After descending 34 steps, we advance to the apartment, where the remains of 43 infantas and infantos are interred. In another apartment, beneath the chancel, and still more magnificent, are interred the remains of the kings and queens. It has the form of an octagon, and is 31 feet in diameter and 38 feet high, and is incrusted with beautiful marbles of various colours, and decorated with gilt bronze. The door is in one of the angles, and immediately opposite to it is the altar; the other six angles are separated by 16 double Corinthian pilasters. In the intervals are arranged 24 urns or tombs, four being in each angle. There are other two beyond the entrance, resting on the claws of a bronze lion, and both of marble. Sovereigns, principally of the Austrian dynasty, occupy fourteen of these tombs, each sepulchre having an appropriate inscription. Only two of the princes of the French line are interred here. A large bronze lamp, surrounded with 24 chandeliers, hangs from the centre.

On the east and south of the palace are a series of gardens supported with walls, and laid out in terraces, which give them the appearance of hanging gardens. The ground is very unequal, and the greater part of them are disposed in the form of an amphitheatre. Ingeniously constructed stairs form the communication between the gardens.

A beautiful road, about a quarter of a league in length, and planted on both sides with lofty elms and linden trees, leads to the village of the Escurial. A subterraneous corridor, arched with freestone, and called the Mina, leads also to the village. Another road leads to Fresneria, a country house situated a quarter of a league to the east of the palace, and in the centre of it is a piazza, supported by Doric columns. The road to Madrid is excellent, but is through a naked country, without fields or pastures. In going from Madrid, it first winds along the Manzanarez; and leaving the Casa del Campo, it passes Pardo, and then three houses in succession, where relays of horses are provided. It then conducts to Valde Morillo, from whence the Escurial is first seen.

The beautiful gardens of the Escurial are intersected by woods and meadows, containing numerous streams and fountains, and small lakes abounding with fish. In the middle of one of these lakes is a covered pavilion, adorned with eight columns, and encircled with a little garden bordered by a balustrade.

The lofty mountains which separate the province of Old and New Castile, surround the Escurial. They are dreary, bare, and uncultivated. Spacious reservoirs have been constructed in these mountains for collecting the water, which is conveyed by an aqueduct to supply 92 fountains. The royal family, before the Spanish revolution, inhabited the Escurial from September to December, a season almost wholly employed in devotion. Since the invasion of Spain by the French, the internal decorations of the Escurial have been greatly injured, and the finest paintings have been carried to the Louvre. The position of the Escurial, according to trigonometrical observations, is West Longitude 4° 7′ 50″, and North Latitude 40° 35′ 50″. See Townshend's *Travels in Spain*, vol. ii.; Laborde's *View of Spain*, vol. v. p. 143—155; Link's *Journey through Portugal*, p. 302; and Francisco de los Padros *Description breve del Monasterio de S. Lorenzo el real del Escorial*. (*j*)

ESCUTCHEON. See HERALDRY.

ESK. See DUMFRIES-SHIRE, FORFARSHIRE, and *Mid* LOTHIAN.

ESNEH, or ASNA, the *Latopolis* of the ancients, is an important town in Upper Egypt, situated to the west of the Nile, between Assouan and Cous. This place is remarkable for its public baths, and its commerce. The Mahometans have several mosques here, and the Copts a church, which is served by two priests. The Copts from the most distant provinces of the kingdom, repair hither as a place of pilgrimage. The surrounding country is rich and well cultivated, abounding in grain and fruit. In the chain of mountains which stretches to the east of the Nile, and almost opposite to Esneh, are quarries of a soft stone, which becomes hard in the fire, and is used in the fabrication of kitchen utensils.

This town is famous for the celebrated temple of Latopolis, of which we have given a drawing in Plate CXLVIII. and a description in our article Civil Architecture, vol. vi. p. 522. to which we refer the reader. East Longitude 49° 15′, and North Latitude 25°. See Savary's *Letters*, &c. vol. ii.; and Denon's *Travels in Egypt*, vols. ii. iii. (*j*)

ESPALIER Trees. See Gardening.

ESPIRITU Santo. See *New* Hebrides.

ESQUIMAUX. See Hudson's Bay, and Labrador.

Derivation.

ESQUIRE, in the strict and legal acceptation of the term, is a name of dignity next above the common title of gentleman, and below that of knight. Its etymology is evident, the English word being derived immediately from the French *ecuyer*, or, as it was formerly written, *escuyer*; and the French term is derived from the Latin *scutifer* or *scutanus*; the root of all the terms being the Greek word *σκυτος*, a shield. The rank of esquire was at first officiary, but now it is merely honorary. In its original acceptation, as denoting an officiary dignity, it may be traced among the Greeks and Romans. Euripides mentions shield-bearers, *ὑπασπιζων*, *ὑπασπιστης*, and *ασπιδοφορος*; and *armiger* and *scutigerulus* are employed by Plautus. Butes is mentioned by Virgil as Dardaniæ Anchisæ *armiger*. Even among the Britons, according to Tacitus, the office of esquire or armour-bearer was known; for he informs us, that Cartismandica, queen of the Brigantes, married the esquire (*armigerum*) of her husband. The knights of ancient Gaul were attended in their wars by two *ὀπαονας*, or ministers; who seem to have been the same whom Posidonius (*apud* Athenæum) represents as sitting with them at table, bearing their shields. Indeed, almost all the ancient nations of Europe, who signalised themselves in arms, appear to have had this office. The Longobards denominated the person who held it Schilpor, *i. e.* shield-bearer; and the Germans, in the time of Charlemagne, called him Schild-knapa: an appellation not uncommon among our Saxon ancestors before the word esquire was borrowed from the French.

Office known to the Greeks, Romans, Britons, Gauls, Longobards.

Change on the nature of the office.

Originally the office of an esquire was merely to carry the shield of the knight to whom he was attached; but afterwards, as we have shewn in the article Chivalry, (to which we refer for what relates to esquire as connected with that institution,) his offices were more important and numerous. Among the French, the grand escuyer was master of the horse. His business was to assist the sovereign in mounting or dismounting from his horse, and to give him his sword and belt. In the court of the eastern empire, there was an officer called *Σκουταριος*, who used to bear before the emperor the sacred standard, and his *σκουταριον*, or shield, in a case.

Misapprehension concerning the meaning of the term.

It appears, from these instances, that the titles, armiger, ecuyer, esquire, &c. did not originally imply that the persons possessing them were entitled to bear coats of arms, but only that their office was to carry the arms of the knights, or of those persons of superior rank to whom they were attached; so that there is no connection between the strict etymology of the name, and the common acceptation in which it is generally used.

When the office began to be honorary in England.

The name of esquire began to be honorary about the time of Richard II. there being an instance of a person being made esquire by patent, with arms by this king. It is, however, still a matter of difficulty and dispute, what constitutes the distinction, or who is a real esquire; for it is a vulgar error, that any estate, however large, can confer this rank upon its owner. The following are undoubtedly entitled legally to this rank and denomination, viz. esquires of the body; of these there are four to attend on his majesty's person; the eldest sons of knights, and their eldest sons successively: all noblemen's younger sons, and the eldest sons of such younger sons;—the two latter species of esquires, Sir Henry Spelman entitles *armigeri natalitii*. Fourthly, such to whom the king gives arms with this title: these are created either by letters patent, or by investiture, which used to consist in a collar of S. S. and silver spurs: the right of primogeniture in their lineal posterity is also accompanied with this honour. Fifthly, esquires by virtue of their offices, as justices of the peace, but only while he is in commission, unless he is otherwise qualified to bear the title; the officers of the king's courts, and of his household. All the titulary lords, who are such on account of office, or of high birth only, have not, by the common law, any title but that of esquire. In the commission appointing those who were to treat of an union between England and Scotland, a person holding the highest civil station, next to the royal family, is denominated "William Cooper, Esquire, our Keeper of our Great Seal of England." Foreign peers are only esquires in law. To the five sorts of esquires already named, may be added the esquires of Knights of the Bath, each of whom constitutes three at his installation. The sheriffs of counties retain the title during their lives. The heads of some ancient families are said to be esquires by prescription. Colonels, Serjeants at law, and Doctors in the three learned professions, are ranked above the dignity of esquire, and next to that of knighthood. See Selden's *Titles of Honour*. Verstegan's *Restitution of decayed Intelligence*. Blackstone's *Commentaries*. (w. s.)

Persons entitled to the rank of esquire.

ESSAYING. See Mint.

ESSENES. See Free Masonry, and Mysteries.

ESSEQUIBO. See Berbice, Demerara, and Guiana.

Situati

ESSEX is a maritime county on the east coast of England. It is bounded on the east by the German ocean; on the west by the rivers Lea and Stort, with a part of Hertfordshire; on the north by the river Stour and part of Cambridgeshire; and on the south by the river Thames. It is divided from the county of Suffolk, on the north, principally by the Stour; from Middlesex, on the west, by the river Lea; and from Kent, on the south, by the Thames. Measured from east to west, its extent is nearly 60 miles; from north to south about 50. Its outline about 120 miles; its area, as ascertained from the map lately published by the Board of Ordnance, is about 942,720 acres. It was formerly supposed to contain upwards of one million of acres. Even on the lower and more accurate calculation, it reckons among the largest counties in England. Its figure is irregularly quadrangular; its maritime side, in particular, being indented and uneven. On the eastern coast of England there are three counties, which together form a tame continued tract of vast extent, undistinguished by any considerable eminence or ridge: Of these Essex is the most southern; but though it is flat, it is in general sufficiently elevated to be dry and arable. Towards the north-west the country rises; the most level tracts are those of the southern and eastern hundreds. It has been already mentioned, that its maritime side is indented and uneven; it is in fact broken into a series of islets and peninsulas, which are deeply cut in by the arms of the

Boundari

Extent.

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sea, and exhibit evident marks of the force of that element. Along the coast, the greater part of which is protected by embankments, there are extensive and valuable salt marshes; and that part of the county which lies along the banks of the Thames, is also, for the most part, low and marshy.

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The effects of the violence of the sea is no where more conspicuous than in that part of the coast of Essex called Walton Ness. This promontory formerly extended much farther to the east than it does at present; the ruins of buildings having been discovered at a considerable distance, particularly in a shoal called West Rocks, nearly five miles from the shore, which is left dry at the period of great ebbs. On these rocks, a town called Orwell, is traditionally reported to have stood; and the spot where the ruins are found is still distinguished by the appellation of the Town. On the coast of Dengey Hundred also, which is now protected from the sea by embankments, that element, in time past, made great depredations. Off the coast there is a sand called Buxey Park, and old seamen still living have heard their grandfathers say, that, when they were boys, Buxey Park was covered with trees.

ions.

The divisions of this county are both natural and artificial. Its natural divisions are into continent and islands; the latter are numerous, but not extensive, lying partly on the German Ocean, and partly on the river Thames.

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Mersey island, situated at the confluence of the rivers Colne and Blackwater, and separated from the mainland by the small channel called the Pyefleet, is about five miles from east to west, and about two from north to south. It possesses many natural beauties, is well wooded, varied with hill and dale, containing excellent springs, and of a rich and fertile soil. Towards the south of the county are the islands of Rushley, Havengore, New England, Petten, Foulness, and Wallasea. These are contiguous to each other, and possess a rich soil. Canvey island is in the south-west of the county, situated nearly at the mouth of the Thames, and surrounded by the branches of that river.

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The artificial divisions of the county are hundreds, towns, parishes, and hamlets. There are fourteen hundreds, and five smaller divisions, called half hundreds, viz. Becontree, Chafford, Chelmsford, Clavering, Dengey, Dunmow, Freshwell, Harlow, Havering-atte-Bower, Hinckford, Lexden, Ongar, Rochford, Tendring, Thurstable, Attlesford, Waltham, Winstree, and Witham.

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There are three borough towns, Colchester, Harwich, and Maldon, besides the town of Saffron Walden. It contains 404 entire parishes, and four parts of parishes. There are in it fourteen divisional meetings, or petty sessions; and 140 acting county magistrates. It returns eight members to parliament, viz. two for the county, and two for each of the borough towns.

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isions.

It is in the diocese of London, contains three archdeaconries, and fifteen deanries; is in the home circuit, and pays twenty-four parts of the land-tax. Its quota to the regular militia is 960 men; to the local militia, 3653.

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Essex enjoys, on the whole, a mild climate; for though it is exposed to piercing winds from the east, especially during the spring months, these winds are not nearly so cold, or prejudicial to vegetation or health, as the same winds in the more exposed county of Norfolk. Part of the eastern and southern limits, for ten or twelve miles from the sea and the Thames, are subject, during autumn, to thick and unpleasant fogs, which are often productive of agues. This disorder is not nearly so prevalent or so dangerous as it was formerly, before the marshes were so well drained, and the land so highly cultivated as it is at present. The quantity of rain which annually falls in this county is comparatively small, not averaging more than twenty or twenty-two inches.

Soil.

There is great variety of soil in Essex, though, perhaps, there is little of what may properly be called clay. The district called the Rodings, which contains eight contiguous parishes, on the west side of the county, near the borders of Hertfordshire, contains a soil that comes, perhaps, as near to clay as any part of Essex, but which, in fact, is only a strong wet loam. This district is very fertile, but is proverbial for the badness of its roads, and the uncouth manners of its inhabitants. In the eastern part of the county the soil for the most part is of a strong good staple, intermixed, however, with light dry turnip land. Towards the middle and northern part, bordering on Suffolk, the soil varies considerably, some being light, with a species of marl below the surface, at the depth of a foot, or a foot and a half, while other parts are of a moist and rather strong soil. In the western part, which borders on the river Lea, almost every variety of soil is met with, from a wet heavy loam, upon brick earth, to a light, thin, tender soil, upon gravel.

Extent of each kind of soil.

Mr Young, in his agricultural report of this county, divides it into eight districts, in respect to soil, viz. the Roding district, where the soil is so wet and strong, that only one crop is taken after fallow; this district, according to him, contains 156 square miles; secondly, the district of fertile loam, which stretches along the banks of the Thames, and the shore of the German Ocean, and contains 255 square miles; and the third, fourth and fifth districts, which lie partly on the borders of Cambridgeshire, and partly to the north of Rochford, consist of strong land, and contain 222 square miles; the sixth district, which is a turnip loam, and stretches from a little to the south of Colchester, past that town, to the borders of Suffolk, contains 114 square miles; the seventh district is very small, it lies in the north western corner of the county, the subsoil of this is chalk; the last district, according to Mr Young, consists of miscellaneous loams, and occupies nearly the entire centre of the county, besides part of the western border of it; it contains 681 square miles. From this account of the soil of Essex, it will be seen that this county is on the whole fertile, possessing some very rich soil, while scarcely any part of it contains soil of a very poor or unimproveable nature.

Rivers.

Although there are no large rivers in Essex, yet it is well situated in respect of river navigation. The Thames forms its whole southern boundary; the Stour, which is navigable to Shoebury, is its northern limit; and on the west it has the two navigations of the Stort and the Lea. Besides these, the estuary of the Black-water penetrates 12 miles into the county, and afterwards is navigable to Chelmsford. Nearly the whole of the county, except those hundreds near the Lea and the Thames, which are emphatically styled the *Hundreds of Essex*, is well watered by the many brooks and rivers which run through its vales. The principal rivers, which, properly speaking, belong to this county, are the Colne, which rises near Clare in Suffolk, and after passing Colchester, empties itself into a creek of the Lea, between Mersey island and the main. The Black-water, which rises near Saffron Walden, and flowing by Coggleshall and Witham, falls into an arm of the sea at Maldon; the Chelmer, which, rising near the source of the Black-water, fertilizes and beautifies the middle of the county, and passing by Chelmsford, unites at Maldon with the former river; the Crouch, which, after a short course on the south-eastern side, joins the Lea among the marshes of Burnham and Foulness Isle; and the Roddon, which enters the Thames near Barking.

State of property. The state of property in Essex is such as might be expected from its vicinity to the metropolis, and the enterprising spirit and wealth of its farmers; for though there are a few very extensive estates in the possession of the nobility, or some very wealthy private individuals, yet, perhaps, in no county is there a greater number of moderate sized farms, the property of mere farmers, while near the metropolis the land is divided into small portions, to accommodate the merchants of London, or for the purpose of nurseries and garden grounds, to supply the wants and luxuries of that city. The management of estates is entrusted either to attorneys, or to farmers of skill and experience. **Tenures.** With respect to tenures, free-hold are by far the most numerous, extensive and valuable; next to these are copyhold; lease-hold estates are the fewest and least valuable. There are many estates in mortmain, belonging to Guy's and Christ's Hospitals, and other corporate bodies. **Mansions.** The houses of many of the landed proprietors are magnificent; of this description are Wansted House, the seat of Mr Wellesley Long: this is one of the largest houses in the kingdom. Audley-end, the seat of Lord Braybrooke, is not more remarkable for its magnificence, than for the taste with which the grounds around it are laid out. Besides these, may be noticed Gosfield, the seat of the Marquis of Buckingham; Thorndon, the seat of Lord Petre; and Mistley Hall, the seat of Mr Rigby.

Size of farms. Essex, like every other county in the kingdom where agriculture is well understood, and carried on in such a manner as at once to enrich the farmers, and benefit the nation at large, is distinguished for the size of its farms; though it would appear from the account of Mr Young, that there are not so many large farms now as there were in 1767, when he found, in the district of the hundreds, some of above £1000, £1500, and even £2000 and upwards per annum. One of the largest farms in the county at present contains 1600 acres. The character of the Essex farmers, in general, is highly respectable, not merely on account of their intimate knowledge of their own profession, both in theory and practice, but also on account of their general acquaintance with the sciences and arts connected with agriculture. **Rent.** The rent given for land in this county is certainly not high, when the general goodness of the soil and climate, and its vicinity to the best market, are taken into consideration. In the year 1806, the average of the Roding district was about 16s. an acre; of the second district of West Gracey, 25s.; of the third district, 17s.; of the fourth, 16s.; of the fifth, 17s.; of the sixth, 21s.; of the seventh, 15s.; and of the eighth, 20s. At that time the total rent was estimated at £936,320, or, on an average of the whole county, not more than 20s. an acre. Since that period, rents in Essex, as well as elsewhere, have risen considerably, but not to the level of other districts not so highly favoured in situation, soil, and climate. The average of the poor rates is about 9s. in the pound; the composition for tithes, per acre, in 1805, was 4s. 9d. Leases, which formerly were almost universal, latterly have become by no means general; where they are granted, ridiculous or impracticable covenants, which might have been proper a hundred years ago, are too often retained.

Agriculture. Essex may emphatically be deemed an arable county, not merely because by far the largest portion of the ground is under the plough, but also because its grain is of the best quality, and its fields exhibit some of the best specimens of English arable husbandry. **Implements.** Only two kinds of ploughs have gained a firm and general footing in the county; the swing and wheel ploughs, both constructed on a better principle, and much lighter and easier of draught, than are commonly met with in England. They are worked commonly with two horses, but sometimes with three yoked a-breast, without a driver. The other agricultural implements are equally simple and well constructed with the plough; none, however, require to be noticed as peculiar to Essex, except the concave roller, and the bean stubble rake. Thrashing mills of various kinds are not uncommon, and one horse carts have been lately introduced.

Fences. Essex has long been an inclosed county; the fences generally consist of various kinds of wood; but they are, in most parts, so high and thick, that they exclude the sun and air.

Fallowing. On all soils, except sound dry turnip soils, fallowing is practised in Essex, and the fallows are uncommonly well and carefully wrought, being frequently ploughed eight times. It has already been mentioned, that the Rooding district consists of strong wet soil; in this district a singular rotation is followed, viz. fallow, wheat, fallow, barley. In the other districts, the rotations, though various, present nothing peculiar, except what arises from the crops peculiar to Essex, which will afterwards be noticed. **Wheat.** This county has long been famed for the excellent quality of its wheat, which, with that from Kent, always obtains the highest price in the London market. This grain is either sown on a fallow, or after beans or clover: in some parts it is drilled and horse-hoed. Dibbling it is also practised, but not to any extent. Till very lately, scarcely any spring wheat was sown, but now it is gaining ground. The mean produce of the county is about 25 bushels per acre. **Barley.** The barley of Essex is also in great demand: it is sown either after a fallow on strong lands, or on dry land after turnips, seldom after beans, pease, or tares. The average produce of this grain is between four and five quarters: it is seldom made into bread, even the poorest of the people refusing to eat it, except in times of the greatest scarcity. **Oats.** Oats are sown after fallow sometimes, but more frequently after beans, &c. Tartarian, potatoe, Dutch, and black oats, are sown: in some parts of the county, the produce is very large: the average of the whole probably about five quarters. **Beans.** Though a large portion of the soil of Essex is suited to beans, they are not esteemed so highly, nor cultivated so well and extensively, as they ought to be: where grown, they are generally put in after wheat, sometimes but not always dibbled, more frequently drilled; in both cases *hand-hoed*, but *horse hoeing* is neglected: the average crop is supposed to be 27 bushels per acre. **Pease.** Near the metropolis, great quantities of white pease are sown; but this crop is not very common in other parts of the county. **Turnips.** There is not much turnip soil in Essex, but the culture of this root is well understood where it can be practised: they are generally grown after early pease; sometimes, but not usually, drilled, and fed off either with bullocks or sheep: the average price for feeding on the land with sheep is £3 per acre. They are found to succeed best near the coast, it is supposed, from the influence of the sea air. Swedish turnips are also grown to a considerable extent, and a few cabbages. **Potatoes.** Potatoes, which have long been cultivated to a great extent in the northern counties, have comparatively made little progress in the south of England; Essex, however, is an exception to this remark: here

Essex. they are very largely grown, London receiving its chief supply of this valuable root from Essex. Near Barking is one of the greatest potatoe planters in the kingdom, who seldom grows fewer than between 200 and 300 acres. Clover, which most probably was introduced into England from Flanders, and first into that part of England which lies opposite that country, has been so long cultivated in Essex, that it is said now not to produce such certain and full crops as formerly: the same complaint is made in Norfolk. ape. Rape or cole is much cultivated in most parts for food; and about Hedingham, Manningtree, &c. for seed: in the rich district of Romford, they have immense crops of this plant, and manage it in a most admirable manner. ops. Hops were formerly much more extensively cultivated than at present; they are chiefly now grown in the parishes of Hedingham, Maplestead, Colne, Chelmsford, &c.: the sorts are the Kentish, Essex, Worcester, and sometimes the Farnham: they are usually gathered in September. It is remarked, that the Kentish hop-pickers pick nearly one half more than those in Essex; the reason is, that the former work by the piece or task-work. The hops in this county are not very highly esteemed, at least in point of strength they are inferior to the hops of Kent, but not so in flavour. In the neighbourhood of Hedingham, the crops are sometimes very heavy, upwards of 24 cwt. having been gathered from an acre; the average produce is about eight cwt. Hop ground has been sold in this neighbourhood at the rate of £182 per acre, which is equal to 30 years' purchase at £6 per acre.

ble crop. Hitherto, the different crops that have been enumerated, are grown in other counties as well as in Essex; but the following productions are peculiar to Essex: they form a treble crop, consisting of coriander, teasel, and caraway. The seeds of these plants are sown together; the farmer generally takes a partner in this concern, who sows the land, keeps it clean, and cuts, thrashes, and prepares for market the crops, while the farmer provides and ploughs the ground. The connection iander. lasts three years: in the first the coriander is ripe, and generally produces from 10 to 14 cwt. per acre: in sel. the second year the teasel is ready, which generally yields a load or six score staffs, of fifty heads each staff: way. the caraway also this year yields from three to six cwt. of seed. It is not, however, till the third year, that this last comes to perfection, at which period it will yield from 10 to 14 cwt. per acre, while the teasel declines, only those plants coming to a head which were not sufficiently forward the preceding year. The heads of the teasel are bought by the woollen manufacturers for the purpose of dressing their cloth, but they are not nearly so much used for this purpose as formerly. In some parts of Essex there are gardening farmers, who travel about and take grass land, for the purpose of breaking it up and sowing it with caraway seed: they enter into partnership with the farmers, on the same terms ard. as have been already specified. Mustard is cultivated in some of the islands of Essex, and in the embanked marshes. Saffron is not cultivated now in Essex to such an extent as formerly; it is principally grown between Saffron Walden and Cambridge, in a circuit of about 10 miles. One of the best proofs of good husbandry in a district, is the general use and judicious management of turnips where the soil is suitable, and of tares where the soil is too heavy and wet for turnips. In Essex there is not much turnip soil, but tares are extensively and judiciously cultivated. On the lands of this county which have a chalk-bottom, sainfoin is grown; but the crops are not very heavy. Essex. This valuable plant has also been cultivated on a sandy bottom, with more success than might have been anticipated. Though Essex is decidedly an arable county, and stands very high among the English counties for the goodness of this species of husbandry, yet the extent and value of its marshes, as well as the grazing qualities of the district of Epping, give it celebrity as a grazing county also. Grazing land. The proportion of grass land to arable, is supposed to be as one to seven or eight. Hay. Near London, considerable quantities of hay are grown; it is managed much in the same manner as in Middlesex; the produce is often very great, as not unfrequently three loads of 1800 cwt. each load, is got, at two cuttings, from an acre. Marsh land. All the marshes possess very rich and valuable grazing land; but those on the banks of the Thames are greatly superior to those on the ocean or Blackwater; the rent varies from £8 to £10 per acre; the latter are principally taken by the London butchers. The marshes in Dengey Hundred are singular, from the circumstance that they rise in elevation as they approach the sea. The great rise in the price of corn has induced several of the proprietors latterly to let their marsh land to be ploughed. Salt marshes. Between the Blackwater and the Crouch, there are salt marshes, which are very valuable. Epping butter. The dairies of Epping and its vicinity are famous for the richness of their cream and butter: the cows used are principally the Holderness, Leicester, and Derby, though other breeds are often mixed. In making Epping butter, the milk is suffered to stand 24 hours, when the cream is skimmed off, and the milk is drawn into other vessels, where it remains for about 20 hours, when the cream is again taken off: this is called *doubling*. It is afterwards put into deeper vessels, when all the remaining cream is separated from it: this is called *trebling*. The butter made from the two last skimmings is of inferior quality. There is one thing peculiar to the dairy-women, which is, that there must be a certain proportion of sour in the cream; otherwise they cannot ensure good butter. The butter made by the smaller farmer is either carried to Epping market, or sold to higglers; but the large farmers generally agree with some Clare-market butter-man for the whole produce of the dairy.

Calves. Essex has long been noted for its calves. Formerly it was supposed that more were bred and fattened here than in any other English county; but the practice is on the decline. Besides the calves that are bred in Essex, great numbers are brought from other parts of the kingdom, and fattened here, especially by the farmers in the Burnham and Southminster marshes. To promote their fattening, they are frequently given a small ball composed of the powder of fenugreek, wheat-meal, and a small quantity of powdered chalk, mixed up with mild ale. Essex is not famous for its live stock, though in some parts the Devon breed of cattle are gaining a footing. Sheep. Where early lambs are in demand, the Dorset sheep are kept: besides these, there are in the county a mixture of Norfolk, Welsh, and Wiltshire. Hogs. Considerable attention has been paid to the breed of hogs: there is one kind very valuable, called the Essex half black; the Berkshire is the favourite breed in the southern parts of the county. The Suffolk breed of horses are generally employed for agricultural purposes. Oxen are seldom wrought.

Decoys. There are several decoys among the islands and marshes; the most considerable is in Mersey island: when any person approaches the decoy, he takes a piece of lighted turf in his hand, as the wild ducks, it is said, would otherwise smell the person, and immediately quit the pond.

Timber. Essex is a well-wooded county; for, besides the timber in the hedge-rows, it is calculated that there are upwards of 50,000 acres of woods and woodlands, which, connected with the hedge-row timber, are reckoned worth nearly three millions. There are some very large trees in the county; a cedar at Faulkburne Hall is supposed to be the largest in the kingdom; its girth, at six inches from the ground, being 18 feet; at 10 feet from the ground, 14 feet; and its height to the first branch, nine feet. In the church-yard at Woodford, is a remarkable yew tree; the spread of the boughs forms a circumference of 180 feet; its girth, at four feet from the ground, is 14 feet. **Fairlop oak.** But the most remarkable tree in Essex is the Fairlop oak in Hainault Forest; the tradition of the country traces it half way up the Christian era. It has lately been much injured by fire, it having been customary, on the first Friday in July, to hold a fair under its branches: on one of these occasions, it accidentally took fire. Before this accident, its branches overspread an area nearly 200 feet in circumference.

Forests. In the reign of James II. the forest of Essex, as it was called, extended almost over the whole county. The forests of Epping and Hainault still retain the name, and support a few deer; the extent of forest land is supposed to be about 10,000 acres. In the marsh districts, osier plantations are much attended to, and are found to be very profitable. There are no extensive orchards of apple or pear trees, but many cherry ones at Burnham, Southminster, &c. The wastelands, including the forests, are estimated at 15,000 acres.

Draining. The agricultural improvements of the county are many and numerous; of these by far the most important and the best understood is under draining. From the moist nature of a great part of the soil, this improvement was much wantod, and it has, in general, been carried on, on the most scientific principles, and with great care and skill of execution. **Manures.** Almost all the known kinds of manure are employed in Essex, but chalk is not so commonly used as formerly. **Embankments.** From the nature of the sea coast, as well as the south boundary of Essex, embankments are absolutely necessary; indeed, the whole shores of Essex are embanked, except at Purfleet, Southend, and Harwich: most of the embankments are old.

We have dwelt thus long and fully on the agriculture of Essex, because it is in general excellent, and because it is this which principally distinguishes the county. In no other respect is it of much note, and therefore our remaining account will not detain us long. As intermediate between its agriculture and manufactures, its fisheries shall be first considered.

Fisheries. There are very few ponds for fresh water fish in the county, though, in the vicinity of London, they would pay well; and it appears, that formerly there were several ponds of this description. **Salt water stews.** In Foulness Island there are salt water stews for various sorts of sea fish. **Oyster fishery.** But oysters are the fish for which Essex is particularly celebrated. The *spats* or small oysters are brought chiefly from Portsmouth, and the neighbourhood of Chichester. The principal breeding rivers in Essex are the Crouch, the Blackwater, and Colne. Though the produce of this fishery has obtained the general name of Colchester oysters, yet they are of several kinds: the Pyefleet is in most request. The creek in which this species is found, extends from the river Colne, to the Strode, at the entrance of Mersey Island. The creeks extending from the Thames round Bomfleet are also famous for producing good oysters. The Walfleet and Burnham oysters are the product of the creeks and pits of the river Crouch. The dredging boats employed are from 14 to 30 or 40 tons; the fitting out one of 20 tons, will require £150. There are from two to four men in each vessel, who are paid by shares, and the master has a share for the vessel. There has been an increase of boats, and of course of men, of more than one half, within the last 50 years; the number of vessels being now upwards of 200, and of men and boys above 500. The quantity of oysters taken in a season is supposed to be above 20,000 bushels. The principal market is London; they are also sent to Hamburgh, Bremen, Holland, France, and Flanders. Many vessels belonging to Essex are also employed in the cod, turbot, mackrel, herring and sprat fisheries.

Manufactures. Formerly Essex was rather noted for it woollen manufacture; but latterly it has much declined. Baize, however, is still made at Bocking, Baintre, and Colchester; at the latter place, before the war in 1794, the number of hands employed, including the neighbourhood, was about 20,000; but the war reduced the number to about 8000. In some of the villages, sacking and hop bags are manufactured. Near Woodford Bridge is an artificial slate manufactory; not far from Leyton, on the Lea, are mills for making sheet lead; and in the vicinity of the metropolis, are several large calico printing manufactures.

State of th poor. The state and expence of supporting the poor, unfortunately constitute a very important article in the statistics of every county of England. On this subject there has been no official and accurate information since the year 1803. At that period, in Essex there were 177 parishes, who maintained their poor in workhouses. The number was 2969; the expence was at the rate of £13, 14s. for each person. The number of persons relieved out of workhouses was 35,368, besides 6780 who were not parishioners; the expence was at the rate of £3, 16s. 9d. for each person. The number of persons relieved in and out of workhouses was 38,337, besides non-parishioners. The total expence was £183,582, or at the rate of £4 : 15 : 9 for each person. The number of parishioners relieved by the poor's rate was 17 in a hundred of the resident population. There were at that time 238 friendly societies, the number of persons belonging to them being six in a hundred of the resident population. The amount of the total money raised for the poor, was 19s. 1½d. the head on the population.

Mineral Essex is a very uninteresting county to the mineralogist. It is nearly exempt from quarries, or any mass of rocks; and it possesses no mines of any kind. It has, however, already been noticed, that chalk is found on the borders next Cambridgeshire; but the most extensive chalk quarries are at Purfleet. **Purfleet quarry.** On the estate of Mr Whitbread here, there is a bold cliff of chalk, covered by many feet of surface loam. It appears to have been wrought for many years; but certainly never with so much enterprise, nor in such an economical and effectual manner, as at present. Most of the chalk is shipped in vessels, which can come nearly up to the quarry. But though Essex is so uninteresting to the mere mineralogist, there are appearances in parts of it, which must be instructive to the geologist. **Harwi Cliff.** At Harwich, the conversion of the clay ooze into a stone so hard that it is employed for building, may be distinctly traced. There are masses of it which are at one end ooze, and at the other stone. There is also, in the cliffs near Harwich, a stratum of concreted shells; and valones of lephants. lsorlog.

rious teeth of large animals, among which are some of elephants, have also been laid bare by the falling of the cliff. *Bones* of elephants have also been discovered in other parts of Essex. The whole island of Foulness, and probably some other of the Essex islands, has evidently been formed, as on it there are layers of oyster and cockle shells. In the banks of the Thames at Dagenham, a very destructive breach was formed in 1707 by the violence of the wind and tide. While the works for repairing this breach were carrying on, a very extensive stratum of *moorlog*, or cotton wood, was found. This stratum was 10 feet deep. Several stags horns were lying above the moorlog.

ntiquities.

Numerous antiquities have been discovered in Essex. The great Roman way, now called Stane-Street, led from Colchester through the middle of the county to Bishop Storford in Hertfordshire. Of the five Roman stations in this county, Camolodunum, the present Colchester, was unquestionably the principal one. Tessalated pavements have been discovered in several places; and the remains of a Roman villa near Ridgewell.

ltham bey. gular ns.

Before the dissolution of monasteries, Essex contained 47 religious houses. Of these, two were mitred abbies, six common abbies, 22 priories, three nunneries, three colleges, two preceptories of templars, and nine hospitals. Of these, so much of the remains of Waltham Abbey still remain, as to prove that it must have been, when complete, one of the most curious and perfect specimens of the ornamented columns, semicircular arches, and other characteristics of the Norman style of architecture. In the parishes of Chadwell and Little Thurock are several caverns formed in the chalk, which are supposed to have been the granaries of the ancient Britons.

idge.

The celebrated Bow Bridge crosses the Lea about two miles to the east of London: it was built in the time of Henry I. and is supposed to have taken its name from being the first *bow* or *arched* bridge erected in this county. In the time of Henry III. a singular toll was granted, by which every person carrying across it a dead Jew, was obliged to pay eight-pence.

lar ms.

There are several singular customs, of great antiquity, still existing in Essex: the most extraordinary is the well-known custom of the manor of little Dunmow, by which a gammon, or flitch of bacon, is delivered to any married couple, who would take a prescribed oath, the substance of which is given in the Spectator. The earliest delivery of the bacon, on record, was in the 23d of Henry VI. The last persons who received it, established their right in 1751. A very singular custom prevails in the manor of Rochford; this is the holding of what is called the *Lawless Court*: it is held in the open air, on the midnight of the first Wednesday after Michaelmas day; all the business is transacted in whispers, and the minutes are made with coal instead of pen and ink. The steward opens the court in as low a voice as possible; those tenants who neglect to answer are heavily fined, and every absentee forfeits double his rent for every hour's absence: the time of assembling is from 12 till cock-crow. In Chingford parish, there is an estate held in a singular tenure from the rector; on every alienation, the owner, with his wife, man-servant, and maid-servant, comes to the parsonage, where he pays homage in the following manner: He blows three blasts with a horn; carries a hawk on his fist, and his servant has a greyhound, both for the rector; he receives a chicken for his hawk, a peck of oats for his horse, and a loaf of bread for his greyhound. They all dine, after which he blows three blasts with his horn, and they depart. The custom of the manor of Woodford is that called *borough English*, by which the younger son inherits.

Celebrated men.

Several men of considerable celebrity have been natives of Essex; among whom may be mentioned, Philamon Holland, called the translator general of his age: he was born at Chelmsford in 1551. Thomas Audley, Lord Chancellor of England, in the reign of Henry VIII. Samuel Purchas, who enlarged and republished Hackluyt's *Collection of Voyages and Travels*: it is well known under the title of "Purchas' Pilgrimage;" and Sir Thomas Boe, the first English ambassador to the East: the celebrated Alexandrian MS. of the Greek Testament was brought by him into this country. Nor must Edward Bright, a shop-keeper of Maldon, be forgotten; few men have reached a greater size and weight than he; at the age of 12 he weighed 144 pounds. The last time he was weighed, about a year before he died, his weight was 584 pounds; his body, round the chest, was five feet six inches; round the belly six feet 11 inches; he died at the age of 29.

History.

The Trinobantes inhabited Essex at the time of the Roman invasion: They had two considerable fortified stations—one of which was at Colchester. It is said that one of their princes invited Cæsar into Britain, in consequence of disputes among his tribe. When the Romans divided the country, Essex was included in that part called Flavia Cæsariensis; the five principal stations of the conquerors were all seated on the road which formed the fifth Iter, from London to Venta Icenorum. During a certain period of the Saxon Heptarchy, Essex formed a separate kingdom, called East Seaxa; Erkenwin is supposed to have been the first king in 527. Essex is less noticed by ancient historians than any other of the kingdoms of the heptarchy. William the Conqueror deprived 90 land-owners, of this county, of their lands; and the Norman barons constructed numerous castles, and tyrannised over the inhabitants. In the civil wars between the houses of York and Lancaster, Essex suffered much from the interference of the De Veres; and also in Charles I. time, during the long siege of Colchester. Formerly there were 12 castles in this county, four of which were denominated royal castles: there are two remaining, Languard Fort and Tilbury Fort; in the neighbourhood of the latter, Queen Elizabeth reviewed the army, which she had assembled to oppose the Spanish armada.

Population.

The population of Essex, in the year 1700, was 159,200; in 1750, 167,800; and in 1801, 234,000. On an average of several years, it is found that there has been one baptism to 33 persons; one burial to 44 persons; and one marriage to 128 persons. In 1810, the baptisms of males were 3792; of females 3678; total 7470: the burials of males 2807; of females 2531: total 5338: the number of marriages 1892.

The following further details on this subject are taken from the population returns for 1811:—

Inhabited houses	42,829
Families inhabiting them	51,645
Houses building	255
Houses uninhabited	1,012
Families employed in agriculture . . .	28,517
Do. employed in trade, manufactures, &c.	14,182
Do. otherwise employed	8,944

Estela
Estremadura.

Males	124,839
Females	127,634
Total	252,473
Population in 1801	234,000
Increase	18,473

See Young's *Agriculture of Essex*; Morant's *History of Essex*; Lyson's *Environs of London*, vol. iv.; *Beauties of England*, vol. v. (W. S.)

ESTELA, is a manufacturing town of Spain, in the province of Navarre. It is watered by the rivers Ega and Ureder, is defended by a castle situated in a plain, and contains several churches and convents. There is a university in its neighbourhood, which was founded in 1565. Coarse woollen goods are manufactured in the town, and it contains some distilleries of brandy. Population 4500 (*j*)

ESTHONIA. See REVEL.

ESTRELLA SERRA DE, the *Mons Herminius* of the ancients, is the most extensive and highest range of mountains in Portugal. It is a branch of the high range that divides Old and New Castile, and stretches, like most of the other mountain ranges in the peninsula, from north-east to south-west. It rises from a mountain plain of a considerable height, and is covered with snow during more than four months of the year. Link has estimated its elevation at 5000 or 6000 feet above the level of the sea.

The southern or highest part of the range is called *Serra Brava*, or the wild mountains, from their steep and rocky character; and the northern, or lower part of the range, is called *Serra Mansa*, or the gentle mountains. The whole of these mountains consist of granite. The highest summit is called *Malhao de Serra*, and is a large but gently arched plain, of so great an extent, that the spectator does not at all observe the rough rocky sides that surround the mountain every where but to the north-east. There are two lakes in these mountains. One called the Lagoa Escura, or dark lake, is of a fine round form, and is most romantically situated, being surrounded with high and wild rocks. It is deep and cold. The Lagoa Rotonda, which is the smallest, is completely round. It is surrounded with high rocks, and is remarkable for the transparency of its water. The principal lake is called Lagoa Longa, or Comprides. It occupies the middle of a valley of considerable length. Its breadth is unequal, and, from its marshy banks, it is less beautiful than the other two.

Many large and small rivers take their rise in this range, particularly the Mondego, the Vouga, and the Zezere. (*j*)

ESTREMADURA, *Extrema Durii*, is a province of Portugal, which is bounded by Beira on the north, by Alentejo and Beira on the south, and by the sea on the west. It extends about 140 miles from north to south, and about 70 in breadth, and contains 5440 square miles. It is cut in the direction of east and west by the Tagus, which throws itself into the sea at Lisbon. This province forms a long and narrow stripe of land, extending along the sea shore from the embouchure of the Mondego to below the town of Setuval.

Climate.

On account of its proximity to the Atlantic, the climate is remarkably mild, and is very salutary and pleasant to those who are accustomed to it. During the period between the end of July and the beginning of September, every thing is parched. Not a blade of grass is to be seen, and the evergreens are shrivelled up. The heat continues incessantly, with a sky almost always serene. The north wind prevails in summer; but its direction being changed by the mountains of Cintra, it becomes a north-west, and cools the air considerably. The greatest heat always accompanies the east wind; and in the summer of 1798, the heat was 104° of Fahrenheit: a heat of 96° is not uncommon. The soil round Lisbon consists of limestone and basalt. In some places, the limestone is very close and excellent for building. The basalt begins at the bank not far from the sea, and then proceeds through Quelus towards Bellas; meanwhile a branch of the basalt mountains stretches beyond Lisbon by the Aqueduct, and unites with the abovementioned chain towards Bellas. Hence the basalt country extends as far as Cabeça de Montachique. It properly forms only one mass of basalt, which is occasionally covered with limestone.

Estremadura.

Agriculture.

The mildness of the climate is peculiarly favourable to agriculture, and the soil is productive or unproductive, according to the quantity of rain which falls. Wheat is commonly sown in the neighbourhood of Lisbon; barley is also sown; but rye is only grown for cattle, and oats are never seen. The fallows are ploughed in autumn, a second time in May, and then at seed time, when the autumnal rains have softened the earth. Light soils are dug, but those which are heavy are ploughed with oxen of extraordinary size, strength, and beauty. The harvest is in May. The corn is generally thrashed, but sometimes trodden out by oxen and horses. Putrefied plants are the only manure which is employed. Rye is often in ear in February and March, and is commonly cut down for fodder before it is ripe. Spanish potatoes are occasionally grown; but this root is generally imported from England and Ireland.

Mountains.

The mountains of Cintra consist of granite, composed of clear white quartz, a reddish felspar, and black mica, against which leans a white or foliaceous limestone, or a proper stinkstone. The south side of these mountains is arid, naked, and parched up, and consists of bare heaped up rocks, affording a wild and a dreary prospect. The north side of the range is to a certain height covered with country houses, and charming quintas, forming a shady wood of the finest trees, such as oaks, pines, lemon trees, &c. From the top, there is a fine prospect of the well cultivated valley of Colanos.

The principal fruits of Portuguese Estremadura, are citrons, lemons, oranges, grenades, figs, dates, and almonds. Great quantities of Lisbon wine are made in the province. Salt forms one of the chief articles of its commerce. The principal towns of the province are Lisbon, Leiria, Abrantes, Pombal, Alcobaca, Schiral, Thomar, Santarem, Alanquer, Torres Vedras, Cintra, and Cascaes. The province contains 8 jurisdictions, 400 parishes, and 350,760 inhabitants. (*j*)

ESTREMADURA, is the name of the largest and most fertile, though the least populous and the least cultivated of the provinces of Spain. It is bounded on the north and north-east by the kingdom of Leon; on the east by New Castile; on the south and south-east by the kingdom of Seville in Andalusia; and on the west by the Portuguese provinces of Estremadura, Beira, Entre-Trajo-et-Guadiana. It is about 50 leagues long from north to south, and 45 broad from east to west, and contains about 2000 square leagues.

Mineralogy.

This province is intersected by ranges of hills, the mineralogy of which has not yet been carefully examined. A mine of copper, in a blue and green mixed stone, occurs in the Sierra de Guadalupe, to the south of the village of Logrosen. There is a lead mine, which

Mineralogy.

has been worked on an eminence called Vadija, or valley of Las Minas, about 2¼ leagues from Logrosen, on the road to Zelamea. Another occurs about a league from Alcocer, in a plain intersected by banks of calcareous stone and slate. Blood stones are found near Nabal Villar. A vein of whitish and tasteless phosphoric stone, which, when pounded, takes fire, and gives a blue flame, crosses the road obliquely from north to south, on leaving the village of Logrosen at the foot of the Sierra de Guadalupe. A black earth, which shines when rubbed between the hands, is found upon a very steep mountain on the road between Alcocer and Nabal Villar. Laborde says, that it is a mine of refractory iron. A mine of iron on a sandy stone, containing very fine red ochre, is found between Alcocer and Orellona. A blackish mineral, which Mr Bowles regards as an infusible iron, which strikes fire with steel, and contains a red emery, is found on the mountain of Lares, about a league from Alcocer. This mine was worked by the Moors, who erected a fortress on the mountain, which still remains. The mountain is composed of a brown freestone, mixed with quartz. Near Alcocer, there also occurs a smooth emery, with grains, containing a small quantity of gold. It was likewise worked by the Moors.

Silver is found in a whitish stone, with a white mica, on the mountain to the north of Logrosen. It also occurs upon an eminence called Chantee, towards Zalamea, two leagues from the eminence called Vadija. It is found with lead, in a granite rock cut against its natural direction. The vein also contains spar, quartz, white and yellow pyrites, and a black shining and crumbling pyritous matter. This mine has been worked, but was abandoned in consequence of being filled with water. Mr Link informs us, that before he arrived at Almaraz, he found along the hill to the northward of the Tagus slaty granite, on which, nearer the vertex, rested a clay slate, mixed with much mica. Towards the Puerto, he found a great change in the kinds of stone; such as clay slate with mica, sandstone slate, green marl, and between these, strata of carbonates, and traces of phosphates, of limestone, which is also found in strata in those mountains farther to the westward. The sandstone is less slaty higher up the Puerto; and the summit is covered with ratchil. Towards Jorayciego, on the other side, the clay slate and sand slate continue to the neighbourhood of Truxillo, the country around which is composed wholly of granite. Sand slate and clay slate were found near Meajadas, but the ratchil began about the *venta del despoblado*, which, at a village called San Pedro, formed rocks of a kind of breccia, extending along the Guadiana to Merida, from which the course of the river is through plains, or between gentle hills, as far as Badajoz, excepting a pretty high granite mountain on the south side of the Guadiana, near Merida. Soon after this follow hills of a kind of sand breccia, and then a sandy plain as far as Merida.

Several of the Estremadura mountains, particularly that of Guadalupe, are covered with numerous medicinal plants. This mountain has several stags and roebucks. The principal mineral springs in the province, are those of Cheles, nine leagues from Talavera la Real; the Fuente de las Aguzaderas, near Zafra, upon the mountain Castellar; the Fuente dell' Carrasco, near the village of Almabarrin; the Fuente de Bernardo Estevard; near Barcarrota, a small town about seven leagues from Badajoz, and a quarter of a league out of the road from Xeres de los Cavalleros; and another by the side of the Hermitage of St Bartolomé, near Alange, a town three leagues to the east of Merida. The first five of these are cold, and the last is thermal. It is very copious, and has baths, and was much frequented in the time of the Romans, the ruins of a bason and an oval edifice being still visible.

Soil and agriculture.

The Romans were attracted to this province by the fertility of its soil, and the mildness of its climate; and it was converted into a garden, by the industry of the Moors. Upon the expulsion of the Moors it was greatly depopulated, and since that time it has continued in a state of nearly total inutility to Spain. The soil is extremely rich; but it is almost completely reduced to the state of rank pasturage. In the district of Badajoz alone, it is computed that there is a space of waste land 26 leagues long, by 12 broad. Neither gardens, nor orchards, nor fruit, nor mulberry trees, nor hemp, occur in the whole province. Wheat and rye are almost the sole productions, and the quantity grown is nearly sufficient for the support of a scanty population. Olive trees and vines are not numerous. Chesnut trees are more abundant, and afford nourishment to the inhabitants. Every autumn, about 4,000,000 head of sheep are sent into the provinces, and remain during the winter feeding upon the grass. Although agriculture is in this wretched state, yet there are some cantons where it is more flourishing. Gardens and fruit trees abound between the Puebla de la Culzada and Montijo, in the Vera de Plasencia, &c. Olive trees are numerous at Banos; vines at Talavera la Vieja and Banos; and numerous plantations of oak, chesnut, and other trees, round Talavera, between Las Brozas and Arroya del Puerco, in the Vera de Plasencia, and its valley, and near Ervas, Banos, and Bejar. Around Caceres and Plasencia, and in the valley of Bejar, agriculture is more attended to.

Manufactories.

During several centuries, this province possessed some good manufactories of broad cloths, and other woollen stuffs. The principal manufactories which existed before the revolution, were one of hats at Badajoz, established by a Frenchman, two similar manufactories at Zafra, a number of tanyards at Zafra and at Caceres, and a manufactory of broad cloths at Arrago del Puerco. There is a manufactory of second cloths at Ervas, and another very considerable one at Bejar, which sends a quantity to Castile and Andalusia.

Roads.

The roads and inns in Estremadura are very wretched. The road which leads into Portugal is the best kept, and was always repaired when any of the royal family of Spain and Portugal travelled that way. Link describes this road as more magnificent than any of the English roads, and better than most of the French.

There are neither schools nor establishments of any kind in Estremadura, excepting two colleges, the inhabitants being in a state of extreme ignorance.

Political subdivision.

This province contains three bishoprics, Badajoz, Plasencia, and Coria; three cathedral chapters in these three towns, 30 military commanderies, 415 parishes, 172 convents, 31 hospitals, 2 asylums, 2 colleges for the education of youth, 7 cities, 228 small towns, 94 villages, 1 grand military government, 11 particular military governments, 1 intendant at Badajos, and a royal audience at Caceres.

The chief towns are Badajoz, which is the capital, Plasencia, Coria, Merida, Truxillo, Xeros de los Cavalleros, Llerena, Almatana, Zafra, Caceres, Albuquerque, and Olivença.

The principal rivers are the Tagus and the Guadiana, which are navigable, and other eighteen, viz. the Alagon, the Cuyar, the Sabor, the Savar, the Allegrette, the Alamonte, the Guyar, the Navazo, the Naluenga, the Lentrin, the Rivello, the Guadajiera, the Caya, the Mutachel, the Guadarranque, the Gevara, the Albarragena, and the Abrilongo.

The principal mountains are of considerable elevation, some of them being branches of the Sierra Constantina, in the centre of the kingdom of Seville, which it crosses from north-east to south, throwing out ramifications into the kingdom of Cordova, and joining the Sierra Morena on the north. The Sierra de Guadalupe is very high, and of great extent, and projects a number of branches into different parts of the province.

In the years 1787 and 1788, the province contained 416,922 inhabitants, consisting of

Priests	2,441
Parish priests	341
Monks	2,060
Nuns	1,748
Nobles	3,724
Advocates	305
Writers	505
Students	1,446
Servants	11,036

From this scanty population, the traveller often passes through immense tracts without seeing a settlement, a house, or a human being, and without perceiving a tree, or a spot of cultivated land. See Link's *Travels in Portugal;* and Laborde's *View of Spain.* (*w*)

ESTREMOZ is a small fortified town of Portugal, in the province of Alentejo. The town is ill built, but has a large cheerful square in its centre. There is a castle on an eminence, and some outworks of no great importance. There are five religious houses in the town, and a sixth in the neighbourhood, an hospital, and a casa de misericordia. This town belongs to the corregimento of Evora, but being a praça de armas, it has a governor. On the side of the town towards Lisbon, the country is well cultivated, and abounds in orange gardens and laurels, which continues as long as the soil is lime, but, on ascending the mountain, the soil consists of slaty granite, and all cultivation ceases.

A good marble is found in the neighbourhood of the town. There is here a small manufacture of earthenware. Population 6500. (*w*)

ETAT MAJOR, in the French army, corresponding to the staff in ours, is composed of a number of select officers, and constitutes the grand medium for the arrangement and communication of orders. It transmits all instructions relative to the commissariat, and other branches of the interior service of the army; receives reports from detachments, from officers in garrisons, from spies, and, in short, from all officers on duty within the compass of the general's command. It is a receptacle likewise for the papers relating to prisoners and deserters, as well as for all certificates, and written applications. It issues orders of the day, plans of marches and engagements, and may be termed, in a comprehensive sense, the channel for the transmission of whatever requires the decision of a directing head, but is too much matter of detail to be transacted by the commander-in-chief. The *chef* of the *etat major* receives from the general-in-chief a summary of his directions respecting the movement and arrangement of the troops. These directions he extends and distributes to the head of each department, so as to convey the wishes of the commander-in-chief, and to preserve to the latter the disposal of his time for devising and combining plans of operation. The duties of head of the staff are so various as to constitute him the next man in importance to the general. His functions require a comprehensive knowledge of the principles and practice of war, as well as an accurate acquaintance with the scene of local operations. To these qualifications he must join indefatigable exertion, and a perspicuous method of communicating orders. He must be fully competent to answer the questions of the general in every point connected with the movements of the army.

It is now somewhat more than a century since the armies of Europe assumed a magnitude which required the constitution of an etat major as a distinct body. Various parts of the duty had been previously performed by particular officers; but it was under Louis XIV. and in the war of 1672, that the establishment first received a separate form. In the succeeding reigns, various alterations and improvements were made; but such have been the extent of recent changes, that, at the time of the revolution, there were in a French army no fewer than three separate establishments, which divided among them the duties now performed by the collective etat major. The plan of proceeding has since then been so much improved, and the officers in this department so much better selected, that the military triumphs of the French have been, in a great measure, ascribed to the admirable constitution of this department of the service. A system completely regular governs all its operations. No sooner does the commander-in-chief communicate his orders to the *chef* of this department, than they are transmitted to the marshals commanding corps. Each corps of the French army has, moreover, its separate *etat major*, composed of a general of division and assistants, called *Adjoints.* There is even a third kind of etat major, viz. that of each division, the plan of which is, on a smaller scale, the same as that of the former.

From the time of commencing operations, the head of the staff in each corps of the French army keeps a journal of the proceedings, which is composed from the journals of the etats majors of divisions. This forms a narrative of the difficulties which have occurred, the advantages obtained, the losses, exploits, &c. with brief notices of the actual condition of the corps, its position, and the nature of the ground which it occupies. An abstract of this journal, made out in a clear and simple form, is given daily to an officer to be taken to head quarters, who repairs thither with all diligence, and with orders to deliver it to no one except the commander-in-chief, or the head of the staff. Each corps sends its extract at the same hour, so that the head of the staff is enabled to read and compare at once the different reports. The officer bringing the extract is expected to answer promptly all inquiries; and, if any particular corps has been forced to take a station unsuitable to the general plan, the deviation is corrected by the arrangements for the next day, which are drawn up on the receipt of the reports, and dispatched, in return, by the same officer. In addition to these daily communications, a list is transmitted, every third day, of the number of sick and wounded, and of those who remain fit for action. Frequency of correspondence continues the invariable rule, even when the different corps of an army are at a considerable distance. Special orders are given to afford every accommodation to officers travelling as couriers, whether they require horses, carriages, or even escorts. When a division is at the distance of 80 or 100 miles, it still transmits a daily report to head quarters.

Such is the routine of service for the French etat major. In the choice of officers for this department, the French have been careful, since the revolution, to distinguish between the requisites for the staff and the engineer service. While the latter requires extent and accuracy of mathematical knowledge, the proper foundation for the former consists in activity, good sense, and a practical familiarity with military affairs. Men of this character, though unacquainted with mathematics, are capable of reconnoitring at the head of a detachment of horse, and of directing the march of a column of infantry. The points required at their hands, are accuracy of local knowledge, a correct acquaintance with the force placed under their command, and precision in the manner of making their report. The possession of good maps and plans is an object of first rate importance; and to this the French have long paid very close attention.

When we come, after all, to analyse this detail, we find nothing in it which might not, with proper pains, be equalled by the other nations of Europe. The rules prescribed are extremely simple, and the efficacy of the whole results from an accurate subdivision and a correct execution of the duties. The successes of the French have accordingly been owing to the concert and activity which prevailed in their movements, in concurrence with the splendid talents of a few of their commanders. (*x*)

ETCHING, in the arts, is a species of engraving, produced by the action of an acid, or some other corrosive menstruum, upon metal, or other substances susceptible of corrosion. This term is, however, more particularly used, to express that peculiar effect produced upon copper-plate, by the action of dilute aquafortis, which, from its delicacy and softness of expression, has almost superseded the use of the graver. The prints, from plates which are merely etched, possess all the effect which the tool can give in point of strength; but the lines are not so deep as those formed by the tool, and, in consequence, soon become imperfect, from the wear of the plate in the act of printing. In order, therefore, to be enabled to take off a greater number of proof impressions, the etched lines should be cut deeper by means of the graver. In such instances, the work is performed by the joint effect of the acid and the graver, and requires the hand of an excellent artist to apply the tool to the etched lines, without lessening their rich softness.

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The plates of copper to be etched are prepared in the same way as those for engraving. The substances and tools essential to this process, are, first, a varnish to cover the whole surface to be engraved; second, etching needles, which should be made of cast steel wire, about 1-16th of an inch in diameter. A variety of these are required, having points of different degrees of bluntness. The varnish is of two kinds, hard and soft; the former was in use in the early periods of the history of this art, when etching was deemed of no more importance than as an expeditious and easy mode of engraving, and practised by those only who could not guide the graver with professional skill. The soft varnish is now generally employed, being more calculated to produce the peculiar excellence of this sublime branch of art. The hard varnish is prepared as follows: Take equal parts of drying oil and mastic. The drying oil should be prepared from linseed oil, and kept till it acquires a certain degree of viscidity, under which it is said, by painters, to be fat. The oil should be heated in a stoneware pipkin, with a sand heat, and the mastic added in powder. The heat must now be kept up, and the mixture stirred, till the whole of the mastic is dissolved, and the compound becomes an uniform fluid. While yet hot, let it be strained through a fine linen bag, and bottled for use.

Le Boffe's soft varnish.

The following is the preparation of the soft varnish, as recommended by Le Boffe: Take two parts of clear white bees' wax, and melt it in a stoneware vessel, in a sand heat. Then add to the hot wax, in fine powder, two parts of mastic; let it be added gradually, stirred all the time, and till it is thoroughly melted. Next add one part of asphaltum in similar powder, stirring as before, till it is completely dissolved. Let the liquid now cool, but not to lose its fluidity. Pour it into warm water, and mould it with the hands into sticks, or balls, for use.

Lowry's soft varnish.

The soft varnish used by Mr Wilson Lowry, and prepared by himself, is as follows: He directs two parts of asphaltum to be melted in a glazed earthen vessel, with a moderate heat. To this is to be added one part of Burgundy pitch, and afterwards one part of white bees wax; the whole being stirred till the solution is complete. It is now poured into warm water, and worked into masses fit for use.

Method of laying on the ground or varnish.

The copper-plate being prepared, and perfectly clean, is to be placed by the edge in a hand vice, which will serve as a handle. It is now to be heated over a glowing uniform fire, or what will be better, laid upon flat plates of metal heated by a sand bath. This heat must be so great as to melt the soft varnish. For this purpose, one of the balls or sticks, above-mentioned, must be wrapped in a piece of taffety. It is now to be drawn over the hot plate in successive stripes, till it is completely and uniformly covered. Still, however, the varnish will exhibit numerous ridges in the direction in which the ball was drawn over the plate. This will be remedied by what is called a *dabber*, which is formed by wrapping a ball of cotton wool in a piece of Persian silk. While the varnish is still melted upon the plate, the dabber is pressed perpendicularly upon the plate, and withdrawn in the same direction. This will give the varnish an uniform smoothness. Immediately after this, the plate is to be placed with its varnished side downwards, and a flambeau, or large candle, held under it, but at such a distance as to smoke the plate without burning the varnish. The smoke, which is no more than lamp black, becomes incorporated with the varnish, making it completely black, by which means any lines transmitted to it, of a lighter shade, are rendered more conspicuous.

Method of transferring the design to the varnish.

The next object is to transfer the design to the surface of the varnish, which is afterwards to be etched in the copper. Two methods are employed; an outline, or drawing, of the intended size, is first prepared in black lead pencil or red chalk. This, after being made damp by lying between two sheets of wet paper, is laid upon the plate with the drawn side downwards, and then passed through a rolling press. This will give a reversed impression of every line of the drawing upon the surface of the varnish; so that the intended print will be the same as the drawing.

The other method of transferring the outline to the plate, is by covering the back of the drawing with red lead, by rubbing on with a cushion, and rubbing it off again till it will not soil the fingers easily. This is

Etching-board.

laid on the plate with the drawing upwards, pulling it tight, and fastening it at the edges. Every line in the drawing must now be traced with a blunt and smooth pointed needle, similar in form to those used in etching. During the tracing, nothing but the point must touch the plate. To ensure this, a board, called an etching-board, must be used. This is a thin board with a bevelled edge, and supported at each end, so as to form a bridge over the plate without touching it. Without this, the pressure of the hand upon the drawing would cause the varnish to be smeared with red lead, and thus render the outline indistinct. The whole of the lines being traced, the paper is to be removed, when the outline will be seen in the colour of the red lead.

If the surface of the varnish be coated with a paint-like composition of white lead and solution of glue, and the back of the drawing be covered with fine lamp-black instead of red lead, the outline produced by tracing will be in black lines, and very distinct.

Etching needles.

The next process is to trace the lines marked upon the varnish with the etching needle. These, as has been observed, are formed of cast steel wire, about two inches long, and placed in little wood or ivory handles. The points, of which there are great variety, are formed and kept smooth and sharp by rubbing them lengthwise upon an oil-stone, causing the needle to revolve between the fingers as it is moved backwards and forwards. The same operation must be repeated upon a leather strap.

The lines are to be traced with needles of different degrees of fineness on the point, according to the fineness or strength of the lines in the design. This must be left entirely to the judgment of the artist. In landscape or figure etching, the justness of the work will depend upon the dexterity, judgment, and taste of the artist. When the lines are straight, parallel, and at equal distances, the correctness of the work may be much aided by a machine. This is particularly applicable to mechanical and architectural engravings, and has been carried to a surprising perfection by the talents of Mr Wilson Lowry, who may be justly deemed the founder of a new school in this useful branch of engraving.

The point of the needle merely passes through the varnish, laying bare a portion of the copper equal to the breadth of the point. This being completed, the next thing is to prepare for applying the acid for etching the lines, or what is technically called *biting in*. The plate is first surrounded with a composition of bees-wax and pitch and tallow. This forms a kind of wall round the plate, about three-fourths of an inch high, and forms a recess or dish for holding the diluted acid. A lip or spout is formed at one corner for pouring off the liquor into a bottle, whenever it is thought proper to remove it from the plate.

Method of applying the aquafortis.

The aquafortis employed is generally known by the name of refiner's aquafortis, which is generally weaker than what is sold for nitric acid. The first of these should be diluted with from two to three parts of water. The pure nitric acid would require more water. The strength of the liquor should, at any rate, be such as to produce a moderate effervescence with the copper. The acid liquor should be kept in a widish mouthed bottle, with a glass stopper, from which it may be easily poured on to the plate, and back into the bottle from the lip of wax in the corner.

On the first pouring of the liquor upon the plate, small bubbles of air will soon appear, as if emerging from the lines on the plate. The whole mass of liquid should be slightly agitated with a soft brush or a feather, for the purpose of facilitating the escape of the gas. This not only hastens the process, but renders the corrosion more uniform.

Method of applying the aquafortis.

As soon as the finest lines are deemed sufficiently deep, the liquor is to be poured back into the bottle. The plate must now be well rinsed with water, and dried at a heat not capable of melting the wax or varnish. The plate is now examined, and those parts which are intended to possess the lightest shade, are to be what the artist calls *stopped out*. This is effected by a mixture of turpentine varnish and lamp-black, intimately ground together. Those lines which are sufficiently etched, are now to be covered with this varnish, by laying it on carefully with a camel-hair pencil. As soon as the varnish is a little hardened, the etching liquor is to be again poured on the plate, observing the same treatment as before. When the corrosion has again proceeded till the next degree of shade is produced, it is again poured off, and treated as before. By this management, which depends entirely upon the skill and experience of the artist, the most delicate gradations of shade may be produced. When the corrosion is deemed sufficient in every part, the plate must be washed clean, and then uniformly heated to remove the wax from the sides. While the plate is still warm, it must be smeared over with oil of turpentine, or olive oil, or what is cheaper, spirit of tar. Any of these readily soften and dissolve the varnish, by which means it can easily be removed, and wiped clean with a soft cloth, or, what is better, currier's shavings. If, after this, any part should still be not sufficiently corroded, every other part must be again covered with varnish; the nicer boundaries being stopped out with the pencil and turpentine varnish. The acid liquor is now to be applied to the bare part, the plate being surrounded with wax as before. When the additional corrosion is apparent, the wax and varnish is to be removed, and the plate cleaned as before. This may be repeated as often as may be found necessary. The plate is now in a state to take prints from it. But it will be proper to observe, that if the etched lines are not gone over by the graver, or the dry point, the impressions will soon become imperfect from the wearing of the plate. Hence retouching is always necessary, when a great number of impressions have to be taken off. In many popular works, in which the sale is great, the plates require to be retouched several times, before all the required copies are taken off. Hence we see how desirable it would be to use some substance harder than copper for plates. Glass has been proposed for this purpose, but several objections in etching this substance render it impracticable. We do not know that polished hardened steel has been tried. The plates might first be hardened; without afterwards tempering them; they might be polished with great smoothness and accuracy, by machinery similar to that used for plate glass. That the acid would etch these plates as neatly as copper, cannot be doubted, when we recollect the beautiful ornaments put upon polished steel by etching, as we shall explain in the sequel of this article.

Etchi with varnis

The etching with the hard varnish is performed in the same manner as with that already described. When the varnish is first laid on the plate, it requires to be held for some time over the fire, as the linseed oil requires some time to dry, and become stiff. When the smoking ceases, it may be removed. The sign of its being heated enough, is its acquiring such a degree of adhesiveness as to hold any thing fast that may be stuck to it. This trial is made in the margin, where no lines will be required. If the heat be continued too long, the varnish will become too hard, and will be apt to break off when scratched by the needle. In other respects, the treatment is the same as with soft varnish.

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Another variety of etching is performed with what is called the *soft ground*, in imitation of chalk or black lead pencil sketches. The soft ground is prepared by melting a portion of fat oil, or, what is better, veal suet, with the common etching-ground, or soft varnish already described. The mass is to be wrapped in a piece of taffety, and laid on the warmed plate, precisely as directed in laying on the soft varnish, observing the same treatment afterwards. When the covering is cold, take a piece of thin paper, rather larger than the plate, and damp it. Apply it to the coated surface, and turning the edge on the other side, fasten them with gum or paste. When the paper is dry, it will become stretched quite tight. All that is now necessary, is to make a black lead or chalk drawing upon the paper, in the required style, observing not to touch the paper in any other place than the very lines in which the pencil should move; this may be effected by the bridge-like board, which we have already called an etching-board. When the drawing is finished, the paper must be carefully removed, taking hold of it by two corners, and gently raising these, till the opposite corners are liberated. It will be found, that wherever the pencil has pressed upon the paper, the ground will have adhered so firmly to it, that when removed, as had been directed, the ground will be brought away by the paper, from those parts intended to be etched. The ground, however, in these parts is not so entirely removed as it would have been with the etching needle, but a number of minute particles remain, which partially prevent the action of the acid, and thus give an effect to the print taken from such a plate the appearance of a sketch in chalk or black lead pencil. The roughness of the paper on which sketches are made, does not admit of the lines being completely covered with the lead or chalk; so that if one of these lines be viewed by a magnifying glass, it will appear a mixture of black and white spots, which gives the velvety softness peculiar to this style of drawing. The accidental and irregular manner in which surfaces traced by the pencil on the soft ground are covered with small particles of the ground occasioned by tearing off the paper from the plate, produces an effect very similar in point of softness. The paper being removed from the plate, the composition to keep the acid upon it must now be placed round the margin, exactly similar to what has been described in the common etching. The same rules must also be observed with respect to pouring off the acid from time to time for the purpose of *stopping out*, with the black varnish already mentioned in the common process.

It will be proper to observe, and will also appear obvious, that the accidental way in which this chalky effect is produced, will render it impossible to make any improvement in the etching, by any manual process, either with the graver or the dry point. The impressions should therefore be taken from the plate as the acid leaves it. See AQUATINTA and ENGRAVING.

A method of imitating sketchy drawings has been invented, which consists in making the etching upon any compact limestone, such as white marble. The stone being etched in those parts where more or less shade is required, the perfectly white parts corresponding with the polished part of the stone. The stone being wet and daubed with a printer's ball, the rough parts receive the ink in proportion as they have been corroded, while the polished are left free. The paper being laid upon this, and pressure applied, will give an agreeable impression.

Etching upon marble and gypsum.

Messrs Brown and Mawe of Derby, and in the Strand, London, have lately introduced etching upon the very elegant articles which they form of various coloured marbles and gypsum. Vases and other antique ornaments are beautifully enriched with figures etched upon them by acids. If sulphuric acid of tolerable strength be laid upon polished gypsum, it gives to the part a dead white, which forms a good contrast with the polished part. For marbles or any carbonate of lime, the muriatic acid will answer best. The etching has an excellent effect upon black marble. It does not merely deaden the polish, but forms a greyish ground, which is an agreeable contrast to the black polish.

Etching upon glass.

Although glass plates do not answer for prints, etching has been employed to ornament glass with good effect. The corrosion of glass by the fluoric acid gives it the appearance of ground glass, so that when the figures formed upon glass are defended from the acid by any substance, the ground becomes opaque, forming a good contrast to the transparent part. The latter is generally painted representing figures or flowers, in the manner of painting transparencies. The common etching ground is generally used to cover the glass, in the same manner as the copper-plates are first coated, taking the same pains to spread it uniformly. When cold, the figures, but more commonly the ground, require to be formed partly by needles of different sizes; and a flat pointed tool when greater surfaces are to be removed. As soon as those parts intended to be corroded are cut out, they are surrounded with soft wax, as directed to be placed round the margin of the copper-plate, to form a recess for placing the acid. The etching is performed by three processes: 1. By the liquid acid; 2. By pounded fluor spar; and, 3. By the acid gas, or what is more properly called the superfluat of silex. The liquid acid is obtained by distilling the gas from fluat of lime and sulphuric acid, from a leaden retort into a receiver of the same metal, surrounded with ice, and containing a little water. The liquid obtained is to be employed on the glass in the same manner as the dilute nitric acid in etching copper-plates. The second method is the most simple, and is on that account generally practised. It consists in first reducing the fluat of lime, commonly called fluor spar, and *Blue John*, to powder. When the sides of the outlined plate are surrounded with wax to about three-fourths of an inch high, the powdered fluor spar is to be spread upon the plate in a uniform stratum about 3-16ths of an inch thick. The remainder of the cavity must now be filled with diluted sulphuric acid, the water being to the acid as about three to one by weight. It must be placed in a warm situation, but not so hot as to melt the wax or varnish. The sulphuric acid soon begins to liberate the fluoric acid, which in its nascent state corrodes the glass. The gas which escapes carries the silex of the glass along with it in the form of *superfluat of silex*. The fluat of lime used for this purpose should be very pure, that is, free from silex. If the latter be present, the acid will be apt to escape with it, instead of getting the silex from the glass, by which it becomes corroded. The same evil occurs when the bodies to be corroded are exposed to the gas in which silex is present, because it is already saturated with what it should take from the glass. The fluoric acid free from silex puts on the elastic form at a very low temperature, at less than 60°. Hence glass may be very advantageously corroded by being immerged in this vapour. As it combines with the silex of the glass, it becomes a more elastic fluid, called the superfluat of silex. In etching round vessels of glass, it is not so convenient to use the wall of wax to contain the liquid; and hence it will be better to etch bodies of such form with vapour, observing not to apply it so hot as to melt the wax.

When the plate has been exposed to the action of pulp composed of pounded fluor spar and sulphuric acid, till the finest lines are corroded sufficiently, which can only be ascertained by trial and observation, the acid mass is to be removed, and the plate washed with clean water, and dried with a low heat. The parts corroded sufficiently are to be stopped out with turpentine varnish used in etching copper. The rest of the process will be precisely the same as that of the copper-plates, applying every time the same quantity of pounded spar and acid. The pulp which has been used once, may sometimes be used again, since it will be capable of corroding so long as any effervescence appears.

Etching upon steel.

This art of etching upon steel, has been practised at Sheffield and Birmingham for ornamenting polished steel. The corroded part becomes a dead white, while the part unaffected remains polished. Those parts intended to be preserved from the acid, are drawn with turpentine varnish, while that which is to form the white ground is left bare. The space where the acid is to be exposed, is first surrounded by a wall, of a mixture of bees wax and pitch, with the addition of a little tallow. The acid employed is the nitric, diluted with 3 or 4 parts of water, more or less according to the strength of the acid. The proportions will be those which produce the whitest ground. This will be easily formed, by trying different strengths of acid, with a pair of polished steels kept for the purpose. This beautiful art is much assisted by bluing and gilding. (C. S.)

ETFOU, or Edfu. See Civil Architecture, vol. vi. p. 522.

ETHELBALD. See England, p. 590.

ETHELBERT. See England, p. 590.

ETHELRED. See England, p. 594.

ETHELWOLFF. See England, p. 590.

ETHER. See Chemistry, vol. vi. p. 68, 69, 70.

ETHERED. See England, p. 590.

ETHICS. See Moral Philosophy.

ETHIOPIA. See Abyssinia.

ETHULIA. See Botany, p. 296.

ETON, or Eaton, the name of a large village in the county of Buckingham, consisting of a single street, pleasantly situated on the north bank of the Thames, and connected with Windsor by a bridge.

This village has long been celebrated for its public seminary, in which many of the distinguished characters in the kingdom have received their education. Eton College was founded in 1440, by Henry VI. for a "provost, ten priests, six clerks, six choristers, 25 poor grammar scholars, with a master to teach them, and 25 poor old men." It now supports a provost, seven fellows, two schoolmasters, two cadets, seven clerks, 70 scholars, and 10 choristers, with various other officers and assistants. Twelve of these scholars are annually elected to King's College, Cambridge, to which they are removed, according to their seniority, as soon as any vacancy occurs, the average number of vacancies being about nine in two years. They are entitled to a fellowship, after having continued there three years. Two scholars are also sent annually to Merton College, Oxford, where they are named Postmasters.

At the age of 19 the scholars are superannuated, and for their benefit there are a few exhibitions of 21 guineas each, which has been increased by a legacy of L.80 per annum, bequeathed by a late fellow, Mr Chamberlayne.

Besides the king's scholars, there are generally from 300 to 350 independent scholars, or oppidans, as they are called, educated here. They are the sons of noblemen and gentlemen, and reside at lodging houses within the bounds of the college.

Eton College consists of two courts or quadrangles, divided by a handsome tower or gateway. In one of these is the school, the chapel, and lodgings for the masters and scholars. The school is divided into the lower and upper, each of which are subdivided into three classes. The other quadrangle is occupied by the library, the provost's lodgings, which are in the front, and the fellows' apartments. The library, which is on the south side, is one of the best and most elegant in the kingdom, both with respect to its architecture and its collection of books. The books were bequeathed to it principally by Dr Waddington, bishop of Chichester, Dr Godolphin, provost, Nicolas Mann, Esq. late master of the Charter-house, and Richard Topham, Esq. of Windsor. This last gentleman also left many elegant drawings of Greek and Roman antiquities, collected by himself at Rome, at great expence: An excellent collection of books was likewise bequeathed to the library, by a late fellow of the college, Mr Hetherington, who also erected, at his own expence, a neat chapel in the middle of the town for the accommodation of the inhabitants.

The college chapel, which is on the south side, is a very handsome building, ornamented with large abutments, pinnacles, and embrasures, and has sometimes been compared to the chapel of King's College, Cambridge, to which it is, however, much inferior in internal decoration. It is 175 feet long, including the antichapel, which is 62 feet long. In the antichapel is the statue of the founder, by Bacon, which was erected in 1786; and a monument of the young Earl of Waldegrave, who was drowned in 1794, when at Eton school.

A singular custom, known by the name of Montem, takes place every third year on Whit-Tuesday. All the scholars, &c. march in procession with music and colours to a tumulus, which has received the name of *Salt-hill*. The object of this custom is to collect what is called *Salt Money*, which is done by the salt-bearers and scouts dressed in different coloured silks. The salt money has sometimes amounted to £800, from the liberality of the king and the royal family; and this sum is given to the captain, or senior scholar on the king's foundation, for the purpose of supporting him at the university of Cambridge. See Gough's Camden's *Britannia*; and *Beauties of England and Wales*, vol. i. p. 398. (*w*)

ETORPU. See Kurile Isles.

ETRURIA. See Italy and Tuscany.

ETYMOLOGY, (from the Greek *ετυμος*, *true* or *real*, and *λογος*, *speech*,) the science which investigates the nature, origin, derivation, and formation of words.

The subject of etymology being words spoken or written, it may be viewed under two aspects: 1st, As forming a part of particular grammar; 2d, As constituting a branch of the philosophy of language. In the former, the office of etymology is to mark out the different classes of words, or *parts of speech*, as they are usually termed; the purposes which these respectively serve; the inflections or changes which they may undergo; and the modes in which, by composition or derivation, they are to be deduced or formed from one another. In the latter, the etymologist extends his views beyond mere grammatical formations, to the remote and recondite analysis of words, whether primitive or derived, with a view to trace out the actual origin, progress, and filiation of languages, and, if possible, to discover the radical nuclei or germs of human speech, as expressive of human thought. The elucidation of the first branch belongs to grammarians and lexicographers; the second forms an interesting subject of philosophical enquiry.

Considered under either point of view, the importance of the study of etymology cannot justly be called in question. As a part of particular grammar, it constitutes a fundamental and essential branch of it, absolutely necessary for the knowledge of the language, and essentially requisite for attaining either precision of thought, or accuracy of expression. As an object of scientific research, etymological disquisitions, temperately conducted, may contribute much to our acquaintance with the intellectual faculties; throw light on obscure points of history, or national antiquities; or present many curious facts respecting the progress of human knowledge,—they certainly cannot, as some have absurdly maintained, disclose to us the essences of things, but they may at least furnish assistance towards unfolding the actings of the mind in observing and discovering the objects affecting it. Prejudices have indeed been entertained against researches of this description, as if they were founded upon no certain principles, but resting merely upon arbitrary conjecture, were consequently unfit to lead to satisfactory results. But this objection applies not to the nature of the subject, but to the mode in which the investigation of it has sometimes been conducted. If fanciful analogies are allowed to usurp the place of rational observation, etymological discussions may no doubt present a mass of learned absurdities; but when conducted upon comprehensive and philosophical views, and confined within their just and appropriate limits, they may lead to conclusions gratifying to the inquisitive mind, and beneficial to science at large.

For the conducting of etymological enquiries, it is not easy to lay down very specific rules; but some general principles may be mentioned.

In studying or explaining the etymology of any particular language, the nature and genius of the language itself must regulate the mode of proceeding. There are, however, general principles essential to the expression of thought, and consequently common to all languages. Speech is the expression, by articulate sounds, of our internal thoughts and feelings; now, as the operations of the human mind are uniform in similar circumstances, language, wherever formed and introduced, must have proceeded in a track so far uniform, that at least the constituent parts of all languages must be in reality the same, though, perhaps the characters of each part may be more distinctly marked in some than in others. In some, many of the more common relations of objects, or modifications of action, are expressed by minute but significant changes or inflections of the radical word; in others, the changes of the radical word are few, its multiplied relations, or modifications, being denoted by supplementary terms, or by peculiar collocation. The ancient Greek and Latin languages are examples of the former; most of the languages of modern Europe of the latter. According to the peculiar structure of the language in these points, a corresponding difference takes places in the character of its etymology, more refined and complex in some, more simple in others. Where many relations and circumstances are expressed by means of inflection, that branch of etymology which treats of it, must become an important and fundamental object of attention. Such a language possesses this advantage, that when the laws of its inflection are understood, and the radical meaning of the verb or noun comprehended, each word, whatever place it may occupy in the sentence, has its precise relation to the others ascertained. In languages of less artificial structure, where recourse must be had to supplementary terms, much of the sense must depend upon collocation alone. Languages of the former description are more susceptible of variety of arrangement, as well as harmony of modulation; in languages of the latter kind, the arrangement is necessarily more confined and uniform, but it has been thought that accuracy and perspicuity are thereby better attained.

In what manner these varieties in the etymological structure of languages have arisen, has been a subject of dispute. Some have supposed that inflections had their origin from the gradual junction and amalgamation of separate terms with the radical word: thus, in nouns, the terms denoting *species*, *recipient*, or *subject of action*; and in verbs, the terms expressing *time*, *volition*, *command*, or *dependence*, being frequently in common use pronounced along with the word to which they related, came at length to coalesce entirely with the radical word, and to form the *genitive*, *dative*, and *accusative* cases of nouns, the *tenses*, *moods*, or *voices* of verbs, changes that might easily arise when a language was constantly employed by an active, ingenious, and animated people. To others it has appeared more probable, that the progress of language was in a different direction; that speech being intended to communicate the complex feelings and impressions of the mind, at first consisted of what may be denominated mere masses of sound, significant only of these complex impressions, in which substance, qualities, and actions were united and blended without distinction; that, by the operation of external objects, a modification of these impressions taking place, and the agent, the action, the effect, and the quality, becoming alternately objects of direct and specific attention, a corresponding variation to indicate these modifications, took place in the significant sounds; that separate classes of sounds significant or words, being thus formed, farther but minuter variations upon these words themselves were found necessary, to denote the relations in which they were supposed to stand, or the particular mode of operation they were believed to exert: These it was easy to supply by abbreviation, addition, or more emphatic enunciation, at the commencement or termination; and in this manner might be formed the cases of nouns—the tenses, moods, and persons of verbs; from which afterwards might arise, by separation of a part, or contraction of the whole, new classes of words, denoting relation, position, or modification in general, and constituting the classes of adverbs, prepositions, and conjunctions.

In which of these two tracks we are to look for the actual progress of language, is a question perhaps incapable of complete solution, nor, as relating merely to the study of etymology, is it very material to determine it. It will be sufficient for the etymological student, in the first place, to ascertain how far the language to which his attention is turned, partakes of the more simple or more complicated structure, and then to direct his labours so as to obtain an accurate and perspicuous view of the general laws and principles by which the inflections, derivations, and compositions, are regulated. This constitutes what is usually termed the etymology of a particular language, forming a radical branch of grammar, a thorough acquaintance with which renders the subsequent progress comparatively easy.

The second branch of etymology has for its object the analysis and resolution of words, with a view to discover their remote origin, the filiation of languages, or the primitive germs of human speech. For the successful prosecution of this study, a comprehensive view of the nature of language in general, in regard to its object, its constituent parts, and the principles of its formation, is first of all necessary, that no particular analysis may be brought forward inconsistent with the fundamental principles which must operate in all languages. Keeping these in view, and observing accurately the structure and forms of words in the language to be analysed, it will not be difficult, especially in those of regular fabric, to distinguish, with sufficient precision, the radical and primitive parts, from what are only accessary and accidental. If the modes of derivation and composition are found to be uniform,—if the derivative words can all be traced to primitives in the language itself,—and if these primitives can be ultimately resolved into roots, evidently existing in and proper to it, we may, without hesitation, assign to that language the title of *primitive*, and accordingly proceed in our attempts to develope its remote constituent parts, and the laws of its formation and structure. Such we find to be the case in the *Hebrew*, the *Ancient Gothic*, the *Sanscrit*, and some others. If, on analysing a language, we find all these distinguishing features, we may justly regard it, in an etymological view at least, as a primitive, although the similarity of many of its words to those of another might seem to indicate a derivation; in this case, both languages may have been branches from the same root, or one of them, in all its parts, and in its native form, transplanted into a new soil, and there retaining all its roots, with their earlier ramifications unchanged, may afterwards have germinated into branches peculiar to itself. Of this the Greek affords an example. Transplanted probably at first from Phœnicia in the form of the old Pelasgic, it still retained, in its new country, the primeval roots, from which in time emanated, by regular progress, a new and copious language,—a language, however, in which all the words are found to be formed from significant roots still existing within itself: The title of a *primitive* language may, therefore, with propriety, be given to it.

If, on the other hand, a language want these characteristic features of a primitive structure, it falls to be regarded as a *derivative*, and analysed accordingly, with constant reference to the sources from which its words have originated. To this class it is probable the greater part of the languages now existing belong; and the investigation of their formation and affinities affords by far the widest field for the labours of the etymologist. In the course of such researches, interesting facts are often disclosed, evincing at once the filiation of languages, and the common origin of nations; and though the examination of languages alone, when other documents are wanting, will not go far in the elucidation of historic facts, yet etymological enquiries, judiciously conducted, may afford useful aid for judging of the credibility of the details of remoter periods.

In carrying on such etymological enquiries, attention should first be paid to the languages in which the real primitives are to be found. Thus in analysing the modern English, the Anglo-Saxon, the Greek, the Latin, must all be referred to, as each of these have contributed something to the present stock, and without a knowledge of each, the investigation must be very incomplete. In the actual deduction of the words as they occur, discriminating attention is often required. Sometimes, indeed, the origin is too manifest to admit of dubiety. Terms of art, ecclesiastical denominations, and forensic phrases, if transplanted from one language to another, generally bear such manifest marks of their peculiar origin, that they can at once be referred to their primitives; but nouns and verbs in common use, particles, prepositions, and conjunctions, are often so changed in passing from one people to another, that it requires an accurate scrutiny before we can ascertain their parent stem. In such cases, various circumstances call for attention. The successive revolutions in the language which we are attempting to analyse should be studied; changes, both in orthography and in pronunciation, gradually taking place, and these sometimes so considerable, that without remounting to the earlier stages, the connecting links would quite disappear. The varieties of enunciation even of the same words, particularly in the vowels, which accident may have introduced, and habit continued; the interchange of consonants of the same order, as certain organs of speech in different countries are more or less exercised, and the alteration of letters for the sake of more harmonious sound, are all of them fruitful sources of apparent discrepancy, in words of similar origin and import;—while, at the same time, metaphorical applications, restricted senses, and analogical modifications, are no less apt to produce great variations in meaning. All these it is the business of a skilful etymologist to analyse, till the primitive word can be traced through all its changes. Examples of all kinds may be found in every modern dictionary. While the etymologist, by attention to these circumstances, can proceed successfully in his labours, great caution is necessary, on the other hand, to avoid the fanciful and absurd deductions in which lexicographers and antiquarians have too rashly indulged. Etymologies far-fetched, or built upon resemblances purely accidental, ought in general to be disregarded; and unless historical circumstances can be traced, sufficient at least to render the supposed connection or descent probable, if not certain, a few similarities of speech would be too weak a foundation for a system of filiation. Occasional coincidences may arise in languages quite unconnected, and which have no radical affinity; it is only when, by following up the analysis, we can trace the resemblance in the radical stems, that we are warranted to infer the actual descent.

Upon the principles now laid down, etymological enquiries into the structure of different languages might be conducted with success, proceeding by a strict inductive process from the derivative languages actually existing, to the remoter primitive tongues, which furnished the roots whence these have gradually emanated. When arrived at these primitive languages, it might still be an object of curious research to continue the investigation, and endeavour to analyse these primitive languages themselves, till some view could be obtained of the first elements, and subsequent progress of human speech. In every primitive language, it seems by no means improbable, that if the roots could be fully investigated upon just and philosophical principles of etymology, and the application of the elemental sounds in the formation of each distinctly marked out, a peculiar and specific idea would be found attached to the use of every individual consonant, prevailing in some form or other, through all the subsequent ramifications. Not that the general idea could be in view when the words were formed, but that the generalisation arose from the repeated application of the same sound, to express individual objects or individual feelings, concurring in the same common quality. By such an analysis, a theory of language might be formed, according with the progress of nature, and an excellent track would be opened, for tracing the procedure of the human intellect in the arrangement of ideas and formation of speech. A comparison of these primitive roots, too, would best enable us to determine what degree of affinity existed among the languages to which they belong, and, perhaps, throw some light on the much-agitated question, whether all the languages of the world were really derived from one. Probable as the opinion of their common origin must be allowed to be, and strengthened by many striking proofs of actual coincidence, still, to establish it completely, such evidence seems to be wanting, as a radical analysis, upon the principles now mentioned, alone could furnish.

Etymology has chiefly been cultivated by lexicographers and grammarians, a class of writers too numerous to be particularized. Philosophical etymology has principally been studied by the moderns; a few examples of it occur in the writings of Plato and Aristotle, and in some of the works of the Platonists of the Alexandrian school, but these are only incidentally, and not systematically touched upon. In modern times, some of the Dutch philologists, particularly Hemsterhuis and his disciples, have distinguished themselves in this line. Horne Tooke has thrown great light on English etymology, and Dr Jamieson has furnished much valuable information on that of the Northern languages. The expected work of Dr Murray on the languages of Europe, there is reason to hope, will prove a most valuable acquisition to the lovers of etymological research. (J)

EVAPORATION, is the process by which the aqueous particles of bodies are converted into vapour. This process is of two kinds, Artificial, and Natural or Spontaneous. We have already described the general appearances connected with the former, (See CHEMISTRY, p. 37.), and we shall therefore confine our attention at present to the consideration of the latter.

Spontaneous evaporation is promoted by a variety of causes, of which the principal appear to be elevation of temperature, and the successive application of fresh portions of air. Neither of these circumstances, however, can be deemed essentially necessary to the process; since ice gradually wastes away at a very reduced temperature, and even more rapidly under an exhausted receiver, than when it is exposed to a current of atmospheric air.

Various theories have been proposed, with the view of explaining the conversion of water into vapour, at natural temperatures, and its subsequent elevation in the atmosphere; but notwithstanding the frequency with which the process is presented to our observation, and the important purposes which it is destined to serve in the economy of nature, there are few subjects of philosophical enquiry involved in greater obscurity. According to Des Cartes, the action of the sun upon the water converts small particles of that fluid into hollow spheres, which, being filled with a subtile matter, are rendered specifically lighter than air, and thus ascend in the atmosphere. Desaguliers, assuming the hypothesis that heat acts more powerfully on water than on common air, asserts that at a temperature which by its cold condenses air, may be sufficient to cause an evaporation from water, or even from ice. He farther assumes, that the particles of water, after they are converted into vapour, acquire a repellency to one another, and deriving elasticity from the contiguous air, recede farther and farther till the specific gravity of the fluid which they form becomes lighter than air, after which they ascend. The particles of the vapour are supposed to retain their repellent force till by the diminution of the density of the surrounding air, their relative weight is increased, and they again descend in the form of rain, hail, &c.

Theory of Dalton and De Luc.

A theory somewhat similar to this has been supported, with much ingenuity, by Dalton and De Luc. These philosophers maintain, that since water passes readily into vapour *in vacuo*, where the agency of the air is completely excluded, its spontaneous evaporation in the atmosphere may be referred entirely to the operation of caloric. Accordingly, Mr Dalton, agreeably to his opinion respecting the constitution of the atmosphere, asserts, that the aqueous vapour, thus formed by heat alone, exists in air, not in a state of combination with it, but merely of mixture or diffusion;—that it exerts no action whatever with the surrounding gases, but supports itself entirely by its own elasticity;—and that the quantity of it depends entirely upon the temperature of the air, and the pressure exerted by the vapour already formed. He even advances a step beyond this, and affirms that the quantity of vapour which could exist in the atmosphere would be the same, though the pressure of the atmosphere did not exist, as the vapour itself would soon accumulate, and form an atmosphere which would produce on the surface of liquids all the mechanical effects of the air itself.

The principal argument which Mr Dalton has brought forward in support of his theory, is drawn from the well-known fact, that water passes readily into vapour under an exhausted receiver, and where, since there is no air present, the evaporation must be ascribed entirely to the influence of caloric. Dr Murray has shewn, however, that it by no means follows, because water passes into vapour *in vacuo*, at a natural temperature, it will pass into vapour to the same extent, at the same temperature, under the ordinary pressure of the atmosphere. The two cases are indeed totally different. When water is placed *in vacuo*, evaporation cannot, it must be admitted, be owing to the presence of air; but it ought to be recollected, that when the air is removed, its mechanical pressure is removed along with it: and it would be altogether illogical to conclude, that because water passes into vapour in the absence of that pressure, it would do so in an equal degree when exposed to it. "The proper manner of making the experiment," as Dr Murray very properly remarks, "is to exclude the chemical agency of the air, while the pressure of it is preserved; in other words, to place water *in vacuo* under the pressure of a column of mercury 29 inches in height, which is equal to the pressure of the atmosphere. If in this case any vapour were formed, the conclusion would be just, that spontaneous evaporation is independent of any chemical agency of atmospheric air. But the fact will be found very different; for although water introduced into the tube of the barometer at 60° passes into vapour, and depresses the mercury half an inch, that vapour will be completely condensed, and the water retained in the fluid form by a pressure a little greater, instead of being able to exist under the pressure, which is equal to that of a column of mercury 29 inches high. Mr Dalton has endeavoured to repel this objection, by maintaining, what appears to be quite inconsistent with fact, that pressure does not prevent the evaporation of fluids, or at least, that the pressure of the atmosphere is exerted in such a way as to allow, by its partial action, the escape of some of the particles of fluids: for, according to his opinion, "it is not till the depth of ten or twelve strata of particles of any liquid, that the pressure upon each perpendicular column becomes uniform; and that several of the particles in the uppermost stratum are in reality subject to but little pressure." It is unnecessary to observe that this assertion is entirely hypothetical, and even at variance with the known laws of hydrostatics.

Argument from the same quantity of moisture being contained by all the gases in a saturated state.

The hypothesis, however, receives some degree of support from the alleged fact, that the same quantity of watery vapour is contained in equal volumes of different gases saturated with moisture. Saussure ascertained this to be the case with common air, carbonic acid, and hydrogen gas, or rather that these gases exhibited, in the same circumstances, the same hygroscopical condition. Clement and Desormes were also led, by their experiments to infer that all gases contain, under similar circumstances, equal portions of water. It was even stated by Saussure, and the assertion was afterwards repeated by De Luc and Dalton, that the quantity of watery vapour contained in any gas is the same as that which would be contained in a vacuum of equal extent with the space occupied by the gas. These facts, if admitted, seem to favour the opinion that water is converted into vapour, and retained in that state, not by an affinity subsisting between the water and the gas, (for it is not likely that this affinity should be the same with all the gases,) but merely by the watery vapour being raised by the action of caloric, and afterwards diffusing itself mechanically by its own elasticity.

Doubts concerning that fact.

On the other hand, it may be said, that the accuracy of these facts is, from their extreme delicacy, very questionable; particularly as they have rather been deduced by inference, than proved by direct experiment. A portion of water is allowed to be converted into vapour *in vacuo*, and the depression which it produces upon a column of mercury, is assumed as the measure of its elasticity: a quantity of dry air is also introduced into a receiver of equal capacity with that in which the vacuum was formed, and an equal portion of water is introduced, the temperature in both cases being the same. The acquired elasticity of the vapour, indicated by the effects of its pressure upon the mercury in an inclosed barometer, is the same as that in the vacuum, and produces an elevation of half an inch, at the temperature of 60°. It is therefore concluded, that an equal quantity of water has in all these cases been converted into vapour. But, in opposition to this conclusion, it has been said, that the elasticity exerted by the vapour under these different circumstances, is not an exact test of its quantity, unless it be admitted that the vapour is not all attracted by the gases; and this is the very point to be established. If the vapour be combined with the gas, its elasticity will be counteracted in a degree proportional to the attraction exerted; and it is easy to conceive, that, at the point of saturation, the elasticity may be so modified by the power of affinity, as to indicate the same degree of intensity, though the quantities of vapour which are present be very different.

But it has also been urged, in support of this theory, that the quantity of moisture deposited by equal volumes of different gases in a saturated state, is, in all cases, the same when they are exposed to substances which have a strong attraction for water. Clement and Desormes established this fact by experiment with atmospheric air, oxygen, hydrogen, nitrogen, and carbonic acid gas; the differences in result being so small as might naturally be expected from the mode of performing the experiments. But though the argument afforded by these experiments, in support of the opinion that the vapour exerts no action with the gases, must be admitted to be of some weight, it cannot be regarded as perfectly conclusive; since it still remains to be determined, whether the quantities of water, which *cannot* be taken from the different gases by desiccation, are exactly equal; and there appears to be no means of ascertaining this by direct experiment.

Arguments for the theory which ascribes evaporation to the chemical agency of air.

It cannot be doubted, that the gases do differ from one another, with respect to their affinity for water; since unequal quantities of them are absorbed by that fluid under equal degrees of pressure: and though this affinity may be diminished when the water exists in a vaporous state, it is probably never entirely subverted. Upon the whole, then, it may be concluded, that the facts which have been stated are not incompatible with the opinion, that spontaneous evaporation is produced by a mutual affinity subsisting between air and water. This opinion, which is the one generally received, was first suggested by Dr Halley; it was afterwards adopted by Dr Franklin, and has been ably supported by M. Le Roi, Dr Hamilton, Dr Murray, &c. That a chemical attraction does exist between water and atmospheric air, is proved by the fact, that water absorbs a certain portion of its component gases, and retains them in combination with considerable force; and every kind of attraction being mutual, air must also be capable of dissolving water in a degree depending upon this affinity, though modified, no doubt, by the elasticity of the vapour which is formed. Mr Dalton maintains, that the combination is entirely mechanical; and that the absorbed gas received into the vacant spaces, between the particles of the water, is retained there without the aid of chemical attraction. This opinion is somewhat countenanced by the discovery of Dr Henry, respecting the law by which the absorption of gases is regulated. This very able and accurate chemist found, that the temperature being the same, the quantity of any gas absorbed by water, was exactly proportional to the pressure to which it was subjected, or, to use his own words, that "under equal circumstances of temperature, water takes up, in all cases, the same volume of condensed gas, as of gas under ordinary pressure." But admitting the law, as Dr Murray has stated with his usual ingenuity, the conclusion does not follow which has been drawn from it. "In the absorption of gas by water, two powers operate, or may be conceived to operate, independent of pressure,—the affinity between the gas and water tending to combine them, and the elasticity of the gas counteracting this, and placing limits to the combination,—precisely in the same manner as in the solution of a solid, there are two forces operating, the chemical affinity, and the cohesion of the solid. In the absorption of a gas, whatever favours the exertion of the elasticity will lessen the quantity absorbed; whatever represses it, will promote the absorption. These effects are produced by variations of mechanical pressure; the diminution of pressure favouring the exertion of elasticity, and *vice versa.* But from this no just argument can be drawn against the conclusion, that a chemical affinity exists, and is the primary cause of the combination; and the law stated by Dr Henry agrees as well with the one theory as the other."

The principal objection which has been offered against the theory that evaporation is owing to a chemical solution of water by air, is, that according to that supposition, the process ought to go on most briskly, when the air is in a condensed state; but the very reverse is the case. But this objection may be answered by saying, that though the quantity of air, which is thus brought in contact with the water, is increased, its pressure is increased in an equal degree; and the effect of quantity may be more than counteracted by the increased difficulty which the water now has to overcome in assuming the vapourous state. On the whole, therefore, we are disposed to think, that no argument has been urged against this theory, of sufficient force to invalidate its truth; and since a variety of facts, both of a direct and analogical kind, conspire to give it support, we consider it as affording a more satisfactory explanation of the process of spontaneous evaporation than any which has been proposed. We shall, therefore, now proceed to illustrate the nature of the operations, by which the aqueous vapour is supposed to be elevated into the higher regions of the atmosphere. The cause of solution being the stronger attraction of water for air, than for its own particles, the part already dissolved will, in consequence of the superior affinity of the less saturated portion of air immediately above it, gradually diffuse itself, and thus allow the lower strata, in contact with the fluid, to dissolve an additional quantity. The process, like the solution of a salt in the bottom of a vessel of water, will go on very slowly when the solvent is not exposed to any agitation; and, accordingly, it is well known, that evaporation is greatly promoted by wind, which brings a continual current of fresh air, while it carries off the portion of it already saturated with moisture. The water being thus converted into vapour, and gradually elevated into the higher and colder regions of the atmosphere, is partially condensed, and gives rise to all the diversified appearances which we call clouds, mists, fogs, &c. These appearances take place at different heights in the atmosphere, according to the temperature of the air, and the quantity of water which it holds in solution. Hence we can perceive the reason why clouds are higher in summer than in winter; and why a lowering atmosphere generally announces the approach of rain, as it indicates the air to be so copiously loaded with moisture, that the reduction of temperature produced by a very small elevation, is sufficient to condense the excess of water, which the air is unable to dissolve. When different strata of air, saturated with moisture, but at different temperatures, are mixed together, by winds or any other cause, a precipitation of water must be the consequence; for it has been ascertained, that the solving power of air increases in a faster ratio than the temperature. This is well illustrated by the great quantity of rain which falls in mountainous districts, compared with that in flat and extensive plains. If the strata of air which are mixed together be in a state of complete saturation, and differ considerably in temperature, the quantity of water precipitated will be very copious: this may be expected to hold particularly when the strata are in opposite states of electricity, and thus mix rapidly and thoroughly together; hence the reason of the very heavy showers which usually accompany thunder storms. If the temperature of the atmosphere where the condensation takes place be sufficient to freeze the watery particles as they are formed, snow is produced; but if they have time to collect into drops before they are frozen, they become hailstones. Southerly winds are commonly followed by rain, because being warm, and saturated with aqueous vapour, they are cooled by coming into a colder climate; while northerly winds, by being exactly in an opposite condition, are dry and parching, and usually attended with fair weather. When the atmosphere is completely saturated with moisture, and passes from a denser to a rarer state, it suffers a diminution of temperature by its increased capacity for caloric, and being unable to hold the same quantity of water in solution, it deposits a portion of it. It is owing to the same cause that a mist or cloud is formed upon exhausting a receiver with the air pump; and in like manner may be explained the reason why fogs usually cover the tops of hills when a current of air, loaded with moisture, is driven over them. The air, which is perfectly transparent at the bottom of the vallies, because its temperature is sufficient to make it dissolve completely the moisture with which it is charged, becomes opaque in the more elevated regions, on account of the reduction of temperature which it undergoes, partly from change of position in the atmosphere, and partly from rarefaction in consequence of that change. On the contrary, when the atmosphere passes from a rarer to a more condensed state, instead of depositing moisture, its solving power is increased; and it dissolves either wholly or partially, the clouds which may have been previously formed. This is one reason why the rising and falling of the mercury in the barometer become indications of the state of the weather.

Quantity of evaporation from the surface of water.

Dr Halley attempted to ascertain the quantity which evaporates from the surface of water, in natural temperatures, by exposing a circular surface of about eight inches diameter, to a heat equal to that of a summer's day, and found it to be at the rate of six ounces in 24 hours, or $\frac{1}{10}$th of an inch deep in 12 hours. By this experiment, each square foot of surface yields in vapour daily about half a wine pint; a square mile 6900 tons; a square degree 33 millions of tons: (*Phil. Trans.* No. 189.) A surface of eight square inches, evaporated by the natural temperature of the air, without exposure to wind or sun, in the course of a whole year, 16292 grains of water, or about 64 cubic inches; consequently the depth of water evaporated in that time was eight inches. Such experiments, however, are of little value; and no general conclusion can be drawn from them respecting the average quantity evaporated from the surface of the earth. The experiments of Mr Hoyle and Mr Dalton were conducted with greater precision; but still they must be regarded as only of local application. A cylindrical vessel of tinned iron, ten inches in diameter, and three feet deep, having tubes soldered to it for conveying off into bottles the water which it received, was buried in the ground in an open situation, and then filled with gravel, sand, and soil. The whole being covered with grass, and other vegetables, it was allowed to receive the rain, and to suffer evaporation from the surface, as in ordinary circumstances. A register was kept of the water which made its way through the soil into the bottles; and a raingage of equal surface was placed close by, for the sake of comparison. The following Table exhibits the results ob-

Experiments of Mr Hoyle and Mr Dalton.

tained, and also the mean evaporation from a surface of water, for three succeeding years.

	Water through the two pipes.			Mean.	Mean Rain.	Mean Evap. from Ground.	Mean Evap. from Water.
	1796	1797	1798				
	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
January	1.90	.68	1.77	1.45	2.46	1.01	1.50
February	1.78	.92	1.12	1.27	1.80	.53	2.00
March	.43	.07	.34	.28	.90	.62	3.50
April	.22	.30	.18	.23	1.72	1.49	4.50
May	2.03	2.44	.01	1.49	4.18	2.69	4.96
June	.17	.73	—	.30	2.48	2.18	6.49
July	.15	.03	—	.06	4.15	4.09	5.63
August	—	—	.50	.17	3.55	3.38	6 06
September	—	.98	—	.33	3.28	2.95	3.90
October	—	.68	—	.23	2.90	2.67	2.35
November	—	1.04	1.59	.88	2.93	2.05	2.04
December	.20	3.08	1.88	1.72	3.20	1.48	1.50
	6.88	10.95	7.39	8.41	33.55	25.14	44.43
Rain	30.63	38.79	31.26				
Evapor.	23.75	27.84	23.87				

Experiment to ascertain the quantity of latent caloric in vapour.

The writer of this article, employed the following method of discovering, by evaporation, the quantity of latent caloric existing in steam or vapour. A quantity of pure water, equal in weight to 550 grains, was placed in a small glass cup, weighing 440.68 grains, along with a pocket thermometer, the weight of which was 59.32 grains. The whole was disposed as in the experiment described under the article COLD, p. 732; and the exhaustion was then carried on slowly and cautiously, to prevent any part of the water from sparkling over, by too violent an ebullition. In four minutes the water was reduced in temperature from 47° to 30½°; and on the air being admitted, was found to have lost 12.75 by evaporation. It was ascertained, by a calculation founded upon the mean result of several experiments, that the thermometer and the cup which contained the water, would, in point of temperature, have produced the same effect as 130 grains of water; so that the whole quantity of water cooled down might be considered as equal to 550 + 130 — 12.75, or 667.25 grains. This gives $\frac{12.75}{667.25}$, or $\frac{1}{52\frac{1}{3}}$ as the ratio of the portion of water evaporated, to that cooled down from 47° to 30½° or 16½°; and as this quantity must have combined with a dose of caloric, the abstraction of which was sufficient to reduce the temperature of 667.25 grains of water 16½°, the vapour must have combined with $52\frac{1}{3} \times 16\frac{1}{2}$, or 863½°. A slight correction must be applied to the result, to make allowance for the ingress of caloric during the time of the experiment, which was observed to be at the rate of 1° in 6 minutes, or ⅔ of a degree in 4 minutes; so that the water might be considered as having been actually cooled down $17\frac{1}{6}$°. This correction being made, the quantity of latent caloric which combined with the vapour is 898° nearly. The mean result of three experiments, conducted in the same manner, was 894°.

Process of forming ice in India explained on the principle of evaporation.

Having stated the results of these experiments, we may mention, that the process of forming ice in the East Indies, when the temperature of the air is above the freezing point, by exposing water in shallow unglazed earthen vessels, has been usually explained by ascribing the reduction of temperature to the evaporation of the water; and that this must, in many cases, contribute to the effect, cannot be doubted, since the evaporation of $\frac{1}{100}$th part of the water exposed, if the process were instantaneous, would be capable of reducing its temperature 10°. But Dr Wells, in his *Essay on Dew*, has endeavoured to shew, that the principal share of the effect is owing to radiation.

This explanation called in question by Dr Wells.

By exposing water, in circumstances similar to those in which ice is formed in Bengal, this gentleman observed, that the water, instead of suffering a loss of weight by evaporation, became, in some cases, actually heavier by the deposition of moisture from the atmosphere; so that, in such instances, the effect of evaporation in cooling the water, must have been more than counteracted by the caloric imparted by the condensed vapour. One experiment on this subject which he relates, was performed on the evening of the 16th of October. With the view of imitating the method of making ice in the East Indies, he caused a pit, 4½ feet long, 3 feet wide, and 2 feet deep, to be dug in the middle of a garden, and clean dry straw to be afterwards strewed to the height of a foot over the bottom of it. On the straw were next placed a number of small shallow earthen pans, a part of which were glazed, and a part unglazed. In the last place, all the pans were filled with soft water, which had been boiled on the same evening. On the night alluded to, ice appeared in the pans, when the temperature of the air, at the height of 5½ feet, was, according to a naked thermometer, 37°. A dry earthen pan was placed among those which contained water, and the inside of its bottom was found to be as much colder than the air, as the water was in the other pans, before ice appeared in them. Moisture was attracted by this pan during the night, which was afterwards converted into a film of ice.

In the course of his experiments, Dr Wells observed, that water exposed early in the evening in the open air to the sky, lost a little weight during a clear night. This he imputed to evaporation taking place before the water had been cooled enough to condense the vapour of the atmosphere, and to the weight gained afterwards being insufficient to compensate the previous loss. He exposed, therefore, water to the influence of the sky, until it was cooled to 34°; of this he put two ounces into each of two china saucers, which had also been exposed to the air, and then placed the saucers upon the straw-bed. In the morning a thin cake of ice was formed in both saucers, one of which had gained 2½, and the other 3 grains in weight. Dew was also copious in the night. At one time grass was 9½°, and the exposed part of the straw-bed 12°, colder than the air.

Objection to Dr Wells's theory.

Dr Wells regards the result of these experiments as a decided proof, that the cause of the formation of ice, in such circumstances, cannot be evaporation; but before coming to this conclusion, he ought to have shewn, that, during the experiments, there was no evaporation from the surface of the ground, as well as from the water in the pans. For it is easy to conceive, that the evaporation from the extensive surface of the fibres of the grass, might be sufficiently great to cool the air in contact with them below the freezing point, and that this temperature might afterwards be communicated to the air immediately above the pans, either by *conduction*, or the actual transference of the cooled particles of air. Taking this view of the matter, we can explain the reason why ice was formed in the pans, though the water which they contained suffered no loss by evaporation, or even gained a small addition to its weight, as part of the moisture which evaporated from the surface of the ground might have been condensed over the pans. Dr Wells mentions, on the authority of Sir R. Barker and Mr Williams, both of whom witnessed the process in India, that, for the complete success of the experiment, it is necessary the air should be very still; and he adds, that "wind, which so greatly promotes evaporation, prevents the freezing altogether," without seeming to be aware, that this fact is still more irreconcileable with his own hypothesis, it being well known, that radiation is not affected by a transverse current of air. But, admitting the opinion, that evaporation is the cause of the reduction of temperature, a good reason may be assigned why an agitated state of the atmosphere, though it tends to increase the evaporation, may be unfavourable to the formation of ice; because the air in contact with the surface, and whose temperature is reduced by the evaporation, is in that case carried off, and mixed with the general mass, before it has time to communicate its temperature to the water in the pans. No reason can be given, on the theory of radiation, why the congelation succeeds best when the pans are placed in excavations; but, on the theory of evaporation, these excavations afford receptacles for the cooled air, which, having its temperature diminished, is increased in specific gravity, and thus settles in the lowest situations. The slightest agitation of the air would prevent this. Though we state these objections against the hypothesis of Dr Wells, we are not disposed to say, that radiation has no share in the effect, or, that the theory which ascribes the reduction of temperature entirely to evaporation, is altogether free from difficulties. Several experiments, performed with the utmost attention to accuracy, are still necessary for the full elucidation of the subject.

ration arts.

In some of the arts, particularly dyeing and calico-printing, it is necessary to produce a quick evaporation without exposure to the light of day. This is sometimes done by suspending the wet stuffs in buildings for the purpose, having a great number of perforations, so as to exclude the light, but allow a continual current of fresh air to circulate through them; at other times, the same thing is effected by exposing the stuffs in a stove, which has usually a fire, and long flues for diffusing the heat through the room. The stove is furnished with several openings at the top, to allow the escape of the air after it becomes charged with vapour.

The desiccation of other bodies must be carried on, as much as possible, without the agency of heat: Thus the form, as well as the colour of delicate plants, upon which so much of their value in the preserved state depends, would be in a great measure destroyed by exposing them to the heat of a stove. It has therefore been proposed, to dry them in an exhausted receiver, by suspending them over a vessel containing sulphuric acid, the muriate of lime, or any other substance which has a strong attraction for humidity, and allowing them to remain in that situation, until the whole of their moisture was evaporated. It has even been proposed, though with less probability of success, to dry gunpowder in the same manner. On the subject of evaporation, see *Phil. Trans.* Nos. 192, 407, vol. lv. p. 182; vol. lxvii. p. 134. and 257. De Luc, *Idées sur la Meteorologie. Phil. Trans.* for 1792. Dalton's *Essays in the Manchester Memoirs*, vol. v. Saussure's *Essays on Hygrometry.* Murray's *Chemistry*, vol. ii. p. 705. Dr Wells *on Dew.* (A)

EUCALYPTUS. See Botany, p. 229.

EUCERA. See Entomology *Index.*

EUCLASE. See Oryctognosy.

EUCLEA. See Botany, p. 337.

EUCLID, the Mathematician, was born at Alexandria in Egypt, about 300 years before Christ. We have no certain information as to the precise period, either of his birth or death; nor do we possess many particulars respecting his life. It would appear that he resided constantly in his native city, and devoted himself to the study of the mathematics, which he cultivated and taught with distinguished success. Among his scholars, he had the honour of reckoning Ptolemy Philadelphus, King of Egypt, of whom Proclus relates an anecdote, worthy of being preserved, not only as it shews the friendship and familiarity which Euclid enjoyed with his royal pupil, but as it is strikingly characteristic of an enthusiastic geometer, and the only one on record which brings him, as it were, personally before us. Ptolemy, fatigued with the long and unremitting attention necessary to comprehend the demonstrations of certain propositions, one day inquired of his teacher whether he could not point out an easier method of investigation? "*No, sire,*" replied the philosopher, ingenuously, "*there is no royal road to geometry.*"

The work by which Euclid is best known to us, is his Elements; a work which, to use the words of a learned critic, "has weathered the vicissitudes of opinion for two thousand years, and has been translated into all the languages, both ancient and modern, in which there is refinement enough for the expression of abstract truth." Various opinions, however, have been entertained with regard to the share which Euclid had in the composition of these Elements. While some maintain that he was the author of the whole, others assert that the demonstrations only are his, and others that he furnished the propositions alone. As in most disputes of this kind, none of the contending parties are perfectly correct. Independent of the undeniable fact, that some particular propositions were furnished by others, as the 47th of the first book, by Pythagoras, it must be obvious, from the state of the mathematical sciences at the period in which Euclid wrote, that he could not be the author of the whole. Long before his time, mathematicians had been engaged in attempting to solve the famous problems of the duplication of the cube, and the trisection of an angle, problems which they never could have attempted without the assistance of many propositions to be found in his Elements. On the other hand, it seems impossible to grant, what is universally allowed, that he was the first who arranged all the propositions then known into a system, without granting a great deal more. The mind that was capable of putting such a system together, even though the materials had been ready furnished, could hardly fail to discover some room for improvement,—some defect to be supplied, or some weak link that required to be strengthened. Reasoning, then, from what we might naturally suppose to be the process of a mind accustomed to scientific investigation, we shall be led to conclude that Euclid must have been the author of no inconsiderable part of the Elements. This circumstance, however, is immaterial, and not at all necessary to entitle him to the appellation of the Father of Geometry. Even supposing every proposition in the Elements to have been known and demonstrated, still they were but insulated truths, and, as such, of comparatively little value. The young mathematician, unless he possessed no ordinary portion of ingenuity, must have been guided in his studies in a great measure by accident—interrupted at every step of his progress, and obliged to go out of his way for the purpose of investigating a proposition of which he was not at first aware, but which was necessary for the demonstration of a more important truth. The length of time thus necessary, in the most favourable circumstances, for acquiring a knowledge of the fundamental propositions, and the difficulty of bringing them, after they were known to bear on any particular point, so as to be useful in the investigation of new truths, must have presented obstacles of no ordinary magnitude even to the most skilful geometer, and rendered the future progress of mathematical discovery both slow and uncertain. Every person who has studied geometry, or paid any attention to the nature of mathematical investigation, will be ready to admit the truth of these remarks, and to acknowledge the extent of the obligations which he owes to Euclid; nor have the admirers of that distinguished mathematician any reason to lament his being denied, in some instances, the merit of original invention, while it is admitted that, by the skilful arrangement of the discoveries of others, he has put into the hands of his successors an instrument which, at a comparatively trifling expence of time and labour, has enabled them to reap not a little of what is most valuable in the field of mathematical discovery.

As a question has been started with regard to the author of the Elements, so the merit of the work has likewise been a subject of discussion. While some maintain that it is not only the most perfect system of elementary geometry, either of ancient or modern times, but as absolutely beyond the reach of improvement, except so far as to free it from the blunders of ignorant commentators; others complain that the demonstrations are unnecessarily long and prolix, frequently intricate and indirect, and ill adapted to the purposes of instruction. Perhaps in this dispute, too, both parties are wide of the truth. It must be acknowledged, on the one hand, that for "rigid accuracy" of demonstration, perspicuity of language, and beauty of arrangement, the Elements of Euclid stand unrivalled, and that modern writers have excelled in these qualities, exactly in proportion as they have approached the Greek geometer. It must also be admitted, however, that in the present state of the mathematical sciences, even these Elements are susceptible of improvement.

Though they are equally necessary as the foundation of all mathematical investigation in which magnitude is concerned, yet they do not bear the same proportion which they once did to the whole science. They still deserve, as much as ever, to be studied on their own account; but as the field to which they open a way has vastly increased, and still continues to increase, it has become a matter of no inconsiderable moment to abridge, as much as possible, the labour necessary to acquire a knowledge of the elementary truths which they contain. On this account we are disposed to regard some modern treatises of geometry, as possessing advantages unknown even to Euclid; not that they excel, or even equal him, in elegance and correctness of demonstration, but because they conduct the learner with greater facility to the ulterior and more important objects of inquiry. With all these concessions, however, we are not prepared to admit an insinuation that has been sometimes thrown out, as if Euclid owed the continuance of his celebrity to an unreasonable and pertinacious adherence to a system, merely because it is ancient. To such prejudices has been ascribed, and we believe justly, the bondage in which the human mind was long held by the metaphysics of Aristotle. But to ascribe the reputation of Euclid to a similar cause, is to place him infinitely lower than he was ever destined to stand, and to assign to prejudice an authority over mankind, which it never possessed. Bigotry and superstition may retard or suppress a spirit of mathematical inquiry; but we cannot admit the possibility of such a gross perversion of the human intellect, as to suppose that any thing but intrinsic excellence could secure to an elementary system of geometry, the almost unanimous approbation of mathematicians for two thousand years.

The other work to which Euclid is in any degree indebted for his reputation with posterity, is his Book of Data. This treatise, like his Elements, had suffered much from the ignorance of commentators, as well as the depredations of time; but, like the latter, revived with fresh vigour under the renovating hand of Dr Simson of Glasgow. It is still perhaps unnecessarily prolix, and not at all entitled to the estimation in which it was held by the ancients. At the same time it is certainly valuable, as containing the rudiments of the geometrical analysis.

Of Euclid's books on Porisms, nothing can be collected from ancient writers, except that he did treat of such propositions, and that they were regarded by the ancients, as forming a very important part of their analysis. They were restored, or rather discovered anew, by Dr Simson, and published after his death by the late Earl Stanhope. See ANALYSIS, PORISMS, &c.

Besides the subjects already mentioned, Euclid is known to have studied various other branches of the mathematics, particularly the conic sections, optics, and astronomy. See CONIC SECTIONS.

It would be impossible to enumerate all the editions through which the Elements have passed, and the commentaries that have been written upon them since the days of Proclus. Those of Commandini in 1572, and Gregory in 1703, deserve to be mentioned; but it seems to be universally admitted, that Dr Simson's of Glasgow is superior to every other.

Of those who have written on geometry, with the view of accommodating it to the present state of the mathematical sciences, Legendre, Lacroix, Mr Playfair, and Mr Leslie, may be mentioned as the most successful. Mr West too, deserves to be noticed as the author of an elementary treatise of mathematics, which has not hitherto enjoyed the celebrity to which it is so justly entitled.

See *Trans. of the Royal Soc. of Edin.* vol. iii. part ii. p. 154. Simson's *Euclid*, Preface. Hutton's *Math. Dict.* articles Euclid, Elements, &c. Bossut *Essai sur l'Histoire Generale des Mathematiques*, Paris 1802. De la Caille, *Leçons Elementaires des Mathematiques*, Paris 1811. Playfair's *Geometry*, Preface. Leslie's *Geometry*, Notes. *Edin. Rev.* vol. xx. p. 79, &c. (R. G.)

EUCORNIS. See BOTANY, p. 188.

EUDIOMETRY. See CHEMISTRY, p. 104.

EUDOXUS. See ASTRONOMY, vol. ii. p. 588.

EVECTION. See ASTRONOMY, vol. ii. p. 703.

EVESHAM, VALE OF. See GLOUCESTERSHIRE and WARWICKSHIRE.

EVESHAM, is a borough and market town of England, in the county of Worcester, pleasantly situated on a rising ground upon the river Avon, over which there is a stone bridge of seven arches, and where there is a convenient harbour for barges. The streets are in general wide and spacious, and the houses are well built of brick. There are three parish churches, viz. All Saints and St Lawrence in Evesham, and St Peter's in Bengeworth; a free grammar school, a charity school, and an alms house. Although each of the churches has a tower, yet the bells are suspended in a handsome old Gothic tower about 100 feet high, and separate from any other building. This beautiful tower is 117 feet high, and 22 feet by 22, and is considered as the last monastic building erected in England.

There was formerly at Evesham a stately monastery, whose Abbot sat in the House of Peers. Its privileges were valued at £1183 annually at the dissolution. It was founded in 709 by Prince Egwin, who retired here after the Pope had deprived him of the bishopric of Worcester. Of the few vestiges of it which now remain, the principal are the above tower, and a large elliptical arched gateway 17 feet long, ornamented with rich though mutilated images.

The following is the population of the borough according to the late returns for 1811:

Inhabited houses	674
Families that occupy them	714
Families employed in agriculture	313
Do. in trade and manufactures	339
Males	1371
Females	1697
Total population	3068

An account of the battle of Evesham will be found in our article England, vol. viii. p. 618. See Tindal's *Evesham*. (*j*)

EUGENE, Francis, Prince of Savoy, was born in 1663, and was descended from Carignan, one of the three branches of the house of Savoy. His father was Eugene Maurice, Earl of Soissons, general of the Swiss and Grisons, and governor of Champagne in France; and his mother was Olympia Marcini, niece of Cardinal Mazarin, a woman of an intriguing disposition, and once the chief favourite of Louis XIV. He was at first intended for the service of the church, and in 1670 was committed to the tuition of a doctor of the Sorbonne. Here he gave great hopes of proficiency in polite literature; but was observed, even at that early age, to derive the greatest pleasure from the perusal of Curtius and Cæsar; and soon indicated a strong predilection for the military profession. His father, however, having died before his son was ten years of age, and his mother having lost all her influence with the French monarch, who even banished her from his dominions, Eugene found his prospects of promotion in that country considerably diminished. He was still maintained by the king according to his rank; but was refused an abbey, because he was considered to be more addicted to pleasure than to piety; and a commission in the army, because he was of too delicate a constitution. He seems afterwards to have admitted, that Louis nevertheless had some regard for him, and would have at length provided him with a suitable employment in his service; but thinking at the time that his merits were slighted, and feeling himself involved in the disgrace of his mother, he quitted France in 1683, full of enmity against its sovereign, and vowing that he would never re-enter his territories except with arms in his hands. In company with his brother Philip, who had received from the Emperor of Germany the command of a regiment of horse, he arrived at Vienna at the moment when it was closely besieged by the Turkish army. He immediately joined the Duke of Lorraine as a volunteer; and, having greatly signalized himself both in the defeat and pursuit of the enemy, he was appointed, in the course of a few months, to a colonelcy of dragoons. In 1684, he was present at the sieges of Neuhausel and Buda, where he gave such unequivocal proofs of intrepidity and intelligence, that, on his return to Vienna in 1686, the prince of Baden presented him to the emperor with these prophetic words; "Sire, here is a young Savoyard, who will some time or other be the greatest captain of the age." Thus he rose daily in favour at the court of Vienna; and so great was the rapidity of his military advancement, that he was a major-general at the age of 21, and a lieutenant-general at 25. In 1689, when the French monarch declared war against the emperor, and it became necessary to form a coalition against his ambitious schemes, Prince Eugene was sent from Vienna to negotiate an alliance with his cousin, Victor Amadeus, duke of Savoy. That selfish and aspiring prince, who loved neither Louis nor Leopold, and who was ready to betray both as his interests required, was secured on the side of the Imperialists by the title of generalissimo, from Austria,—a subsidy of 20,000 crowns per month from England, a similar allowance from Holland, and the promise of four millions more to defray the expences of the war. Eugene was sent with a reinforcement of German troops to keep him steady to his engagements, as well as to co-operate with him in the field; and, during the seven campaigns, which they carried on with various success, he found occasion for all his talents to watch against the bad faith of the duke, to retrieve the errors of his bad generalship, and to make head against the able tactics of the French commander Catinat. In spite of all these disadvantages, he succeeded in penetrating into France, and had opened a free passage to Lyons, when Amadeus was seized with the small-pox, and Eugene was obliged to withdraw the army to Turin. In reward of his exploits, he received this year the order of the golden fleece; and was created a field-marshal exactly ten years after his entrance into the service. He was greatly thwarted by his unmanageable ally, during the remainder of the war; and at last, in spite of all his vigilance, the duke concluded, in 1696, a separate treaty with the French, whom he soon afterwards joined against the emperor. The king of France, thinking that Eugene was discontented with the court of Vienna, or that they were discontented with him, made a proposal that he should enter his service. He is said to have offered him his father's government of Champagne, an annual pension of 2000 pistoles, and the rank of a marshal of France; but, so strong was the prince's antipathy to Louis, that he rejected the offer with the greatest disdain. "I received gayly," he says in his Memoirs, "the person who brought the proposal, and he did not surely dare to deliver my answer exactly as I spoke it." Notwithstanding the unfavourable result of affairs in Italy, the emperor saw that he was free from all ground of reproach, and sufficiently testified his approbation, by giving him the command of the army in Hungary. In 1697, he took the field against the Turks, who were commanded by the Grand Seignor in person; and inflicted upon them the severest defeat which they had sustained in the whole course of the war. While marching to attack them at Zenta, on the river Teisse, he received an order from Vienna, not to fight a battle in any circumstances; but, having advanced too far to retreat with honour or safety, he hastened to the assault, forced the entrenchments of the Vizier's camp, defeated his army with great slaughter, and made himself master of an immense booty, to the amount of several millions ster-

Eugene.

ling. Of the enemy, 20,000 were killed in the field, 10,000 drowned in the river, and 4,000 taken prisoners; while the victorious Imperialists did not lose one thousand men. But his enemies at Vienna having gained the ascendancy, he was received by the Emperor with the greatest coldness, commanded to deliver up his sword, charged with disobedience of orders, and arrested for trial before a council of war. Upon the report of these proceedings, the populace assembled around his house, and the citizens offered to form a guard about his person, to prevent his being removed for examination. The emperor, either from fear or from conviction, restored his sword, and requested him to resume the command in Hungary. His answer was, as he has recorded it with his own pen, I " will do it upon condition of having *carte blanche*, and of not being exposed in future to the malice of generals and ministers." " The poor emperor," he adds, " durst not give me this full power publicly; but he gave it me in private under his own signature, with which I was quite satisfied." The war with the Turks was terminated in another campaign; and now for the first time since he commenced his military career, he was left at leisure to cultivate the arts of peace. He employed himself in forming a select library, collecting paintings, building palaces, planning gardens, and hearing music, in preference, as he says, to " the talk of idlers." During this interval of peace, he enjoyed the society of the celebrated French General Villars, who was ambassador at Vienna; and with whom he maintained, during the remainder of his life, a most cordial friendship, which was not interrupted even in the midst of hostilities.

When the war of the Spanish succession broke out in 1701, Prince Eugene was appointed to the command of the Austrian army in Italy, which consisted of thirty thousand veteran troops. His cousin, the Duke of Savoy, was now in alliance with the French, and frequently commanded against him in person. The army with which he had to contend, was uniformly superior in number; and was successively conducted by Catinat, Villeroy, and Vendome. Against the first and the last, all his activity was unavailing; but he gained several temporary successes when Villeroy had the command, and even made him his prisoner, in a bold though unsuccessful attempt to surprise Cremona. After two years absence, he returned to Vienna in 1703, to secure for his army more regular supplies of men and money; and being there appointed to the presidency of the military council, he rendered great services to the Austrian empire in that office, by effecting an accommodation with the Hungarian insurgents, and detaching the Duke of Savoy from his connection with France. He was chiefly instrumental, also, in concerting with the Duke of Marlborough the plan of the campaign of 1704, in which he bore so distinguished a part, and which so completely relieved the hereditary dominions of Austria from the formidable danger which threatened them on the Danube: (See BLENHEIM.) In 1705, he was sent into Italy with an army of 28,000 Austrians, in aid of his cousin the Duke of Savoy, who was now heartily exerting himself in opposition to France. During the first campaign, while Vendome commanded the French, he made very little progress in freeing Savoy from the enemy; but, in the following year, when Marsin and La Feuillade were placed at the head of the hostile army, he gained with an inferior force, and after an obstinate contest, the famous battle of Turin, which was followed by the deliverance of Italy, and the invasion of France. Returning to Vienna, he was dispatched in 1708, as a negociator to consolidate the coalition; and then hastened with his army to form a junction with Marlborough, who was encamped at Asch in the vicinity of Brussels. Here he had an interview with his mother, after an absence of twenty-five years; and though his troops were not come up, he concurred with the English general in advising an attack of the French army, and in gaining the decisive battle of Oudenarde. Having ravaged Artois and Picardy, they undertook the siege of Lisle, which, after being obstinately defended by Marshal Boufflers nearly six months, surrendered to the allied arms. While Prince Eugene was actively employed in superintending the siege of the town, his enemies, either at Vienna or at Paris, are reported to have made an attempt upon his life by poison. A letter was put into his hands, which contained only a piece of greased paper, which he threw away; but, being picked up and given to a dog, or rather, as it was said, being tied about the animal's neck, he expired in twenty-four hours, with all the symptoms of having been poisoned. The prince himself remarks upon this occurrence, that there must have been some mistake in the supposed cause of the animal's death; and that the paper probably contained some piece of information, which might have been rendered legible by the fire, or some of the usual applications, in secret writing. In 1709, he found himself, together with Marlborough, at the head of 100,000 men in the Low Countries, opposed to an army of equal force under Villars, who acted prudently on the defensive, and made the confederates pay dear for their successes, particularly in the bloody battle of Malplaquet. It was chiefly by the advice of Eugene, that the allied forces ventured upon that daring assault; and he seems to have been fully aware how much depended upon the result. He had received a wound behind the ear, when forcing an entrenchment; and, when urged by his friends to have it dressed, he instantly replied, " If I am beaten, it will not be worth while; and if the French are, I shall have time enough." " What better," he adds, " could I have done than to have perished, after the serious responsibility which I had taken upon myself?" In 1711, the Emperor Joseph I. died of the small-pox; and Eugene, by his skilful manœuvres, had considerable influence in securing the election of his brother Charles, competitor for Spain. This circumstance, by increasing the power of Austria, rendered the other allied powers less zealous in the coalition against France; and the prince was dispatched to London, in order to retard the progress of a peace. Here he was received in a manner suitable to his merits and reputation, but was unable to accomplish the object of his mission. Though Marlborough was now in disgrace, and it might have been politic to have shunned his intercourse, Eugene met his old companion in arms with undisguised emotion, and passed the greater part of his time in his company. For this, he says, the populace applauded him the more, and the more honest individuals of the opposite party did not esteem him the less. The allies, though deprived of the assistance of Britain, had so much confidence in the talents of Eugene, that they still continued the war in 1713; and, though now obliged to act solely on the defensive, he greatly signalized himself by his active vigilance, and at one time, by a bold advance into Champagne, he occasioned no small alarm to the court of Versailles. At length, all parties being worn out with perpetual war, Eugene was appointed to negotiate with Villars at Rastadt; and, in the course of the year 1714, concluded a general peace between the empire and France. Upon his return to Vienna, he was received, both by the court and the city, with the most enthusiastic testimonies of approbation, and immediately applied himself to improve the state of the public finances. But his respite from the fatigues of war was very short. In 1716, hostilities commenced against the Turks, and he was appointed to the command of the army in Hungary. Attacked in his camp by the grand vizier, he repulsed the enemy with great slaughter, and took the important fortress of Temeswar, which the Turks had held 164 years. He opened the campaign of 1717 with the siege of Belgrade, where he was attended by a number of princes and young men of rank, who were eager to exalt their reputation, and to improve their military skill by serving under him as volunteers. A large army arrived on the 1st of August to relieve the place, when his own was weakened by a fever, and himself labouring under the same disease. But recovering from his illness about the middle of the month, he resolved, as his only hope, to attack them during the night; and after a desperate conflict, drove them from the heights, gained a decisive victory, and received on the same day the capitulation of Belgrade. A peace was concluded in the following year, and he was appointed by the emperor his vicar-general in Italy, with a salary of 150,000 florins. During a long repose of nearly fifteen years, he applied himself to the study of the arts—the arrangement of his books, maps, and plans—the embellishment of his palace and his gardens—and particularly to the perusal of the best authors. Nor was he idle in his public capacity, but exerted himself to regulate the internal state of the empire, and especially to the improvement of its commerce. In 1733, when it was proposed to resist, by force of arms, the intention of the French court to replace Stanislaus on the throne of Poland, he strongly dissuaded the emperor from a war in which he foresaw so little support, and so formidable an enemy; but his counsel was overruled, and he accepted the command of the army at the age of seventy. He was received by the soldiers at Philipsbourg with repeated cries of "Long live our father!" while thousands of hats waved in the air. "My old soldiers of Hungary, Italy, Flanders, and Bavaria, ran to take hold of the knees of my boots; they surrounded me, they fastened on my horse, and even pulled me down with the weight of their caresses: This was assuredly the most delightful moment of my life." Though greatly inferior in numbers, he prevented the Duke of Berwick from penetrating into the heart of the country, and baffled the talents of D'Asfeld by skilful marches; but in the following campaign he finished his military career by operations of a more active nature, taking Trarbach, and delivering the electorate of Treves. Having always advised a speedy termination of so unprofitable a war, he was not dissatisfied at being recalled to Vienna, to assist at the negotiations for peace; and though he took leave of his army with tears, he continued, during the remainder of his life, to be the advocate of pacific counsels. Though naturally fond of military renown, and the most ardent of combatants in early life, his cooler judgment and long experience led him to form a more enlightened opinion of the evils of war. "The thirst of renown sometimes insinuates itself into our councils under the hypocritical garb of national honour. It dwells on imaginary insults—it suggests harsh and abusive language—and people go on from one thing to another, till they put an end to the lives of half a million of men. A military man becomes so sick of bloody scenes in war, that in peace he is averse to recommence them. I wish, that the first minister, who is called to decide on peace and war, had only seen actual service. What pains would he not take to seek, in mediation and compromise, the means of avoiding the effusion of so much blood?"

He spent the remaining year of his life in complete retirement, in the conversation of his friends, in the society of young persons, whose company he preferred, and in a becoming attention to the offices of religion. "I have been happy in this life, and hope to be happy in the next. I have scarcely had time to commit transgression; but I have set a bad example, without thinking, by neglecting the exercises of religion, though a sincere believer in and well acquainted with its doctrines. I have led a soldier's life of indifference, and have acted the part of a philosopher; but my death I wish to be that of a Christian. I never liked boasters either in war or religion; and it is probably from having seen on one side the ridiculous impiety of the French, and on the other the bigotry of the Spaniards, that I have observed a medium between the two. In former days I had so often seen death before me, that I had become familiar with it; but this is not now the case. I then sought it; now I wait for it; but I await it with tranquillity, and look on the past as a pleasing dream. I am fond of the eloquence of the pulpit. When Bourdaloue has made me fear every thing, Massillon makes me hope every thing; Bossuet astonishes and Fenelon affects me. I have forgotten the epigrams of Rousseau, and even his ode to me; but I often read his Psalms and his Canticles." This illustrious commander, who had received thirteen wounds, and who, in almost every one of his numerous battles, had made many hair-breadth escapes, died at length tranquilly at Vienna, on the 10th of April 1736, in the 73d year of his age. He was found dead in his bed, after having retired in good health from entertaining company at supper; and was supposed to have been suffocated by an immoderate defluxion of rheum, to which he was subject. Little remains to be remarked upon his character, in addition to what may be suggested by the sketch of his history, and the extracts from his private memoirs, which we have presented to our readers. In his military tactics he is considered as having frequently bordered upon rashness, and having been generally too lavish of human blood. He was distinguished for personal courage, and for his coolness in the midst of dangers; and he mentions two circumstances, from which he derived the greatest advantages, viz. always reconnoitring if possible in person, and writing with a pencil in the memorandum-book of his aide-de-camp, every order which he gave him to carry. He has been greatly commended for his generous disposition; for the ease with which he descended to an equality with those who conversed with him; for his unaffected modesty, which prevented him from assuming any thing over others, and which rendered him unable to bear, with any tolerable grace, the just acknowledgments which were paid to his merits. See *Biographical Dictionary; Life of Eugene; Modern Univ. Hist.* vol. xxv. p. 151, and vol. xxx. p. 396; *Memoirs of Prince Eugene of Savoy, written by himself.* (q)

EUGENIA. See BOTANY, p. 228.

EUHARMONIC ORGAN, is a very improved musical instrument, the first that ever has been capable of producing *perfect harmony*, or music wherein none of the harmonies are tempered or imperfect, in the widest range of modulation, the invention of the Rev. Henry Liston, minister of Ecclesmachan in Scotland, for which he took out a patent in 1810; (see the *Phil. Mag*. vol. xxxvii. p. 328, vol. xxxix. p. 421; and the *Monthly Mag*. vol. xxxvi. p. 217). The first of these instruments was perfected in Edinburgh, and had a separate pipe for each of the numerous sounds wanted. The 12 finger-keys in common use were made to act always on as many contiguous notes of the scale, by means of six pedals, discharging two *sharps* at a time, and bringing on as many *flats*, or *vice versa*, in the order of modulation; single pedals or *foot* movements being a most important improvement on the separate *hand*-slides in the harpsichords constructed on Dr Smith's plan, and in the organ of the Foundling Hospital, London; and it is somewhat remarkable, that the same system and construction of pedals occurred about the same time to Mr David Loeschman in London, who afterwards took out a patent for applying the same to his improved organs and piano-fortes, for tempered systems. Besides the ✳ and ♭ pedals above described, Mr Liston had others for occasionally shifting the finger-key movements from one pipe to another, higher or lower than it, by the interval of a major comma.

In order to lessen the bulk and expence of this first construction of his organ, Mr Liston afterwards contrived a mode of temporarily lowering the sound of a pipe, either one or two commas, and restoring it again at pleasure, by means of a *shader*, brought and held near to it, but not touching its orifice; and for this contrivance for diminishing the number of pipes, and for some improvements in the bellows, was Mr Liston's patent obtained.

After exhibiting this improved organ during a season in London, to the most eminent of the musical professors and amateurs, Mr Liston published his Essay on Perfect Intonation, a handsomely printed quarto work of 144 pages, besides 40 quarto pages of closely printed music, separately done up, to accompany it. This important work, forming a new era in the theory of music, and its practice on keyed instruments, is prefaced by the most handsome and voluntary testimonials of four eminent London professors, who had performed on and heard the euharmonic organ. The first part of this work treats of the perfect scale, temperament, and the principles and construction of the euharmonic organ; the second part treats of musical chords, and their progressions, modulations, intervals, and their combinations in chords, modulation within the key, and passing into the subordinate keys, &c.; and, lastly, notes illustrative of the text. The engraved examples contain full and very explicit instructions for learning the use of the euharmonic organ, in every key and kind of modulation, and euharmonic changes; and the selection of pieces of music, from many of the best masters, which follow, being all, like the elementary examples that precede them, exactly marked wherever the different pedals are to be pressed by the foot or released, during performance, in order to produce *the exact perfect chords that the several composers intended*; and such, indeed, as the amateurs of music are daily in the habits of hearing, in the performances of correct singers, either alone, or accompanied only by separate perfect instruments *for single parts*, like the violin, violincello, sliding trumpet, &c. (whereon the exact pitch of the notes can be instantly varied at pleasure), or performances wholly by such perfect instruments, for a band of good performers; whose refined and delightful harmony had never, in any considerable degree, been produced, by a single performer, before the exhibition of the patent organ of which we are speaking.

The euharmonic organ seems an essentially requisite instrument to the *singing master*, by which, in the shortest and most perfect manner, a habit of correct intonation in the various keys, and harmonizing with their fellow performers in every case, might be acquired, and fixed in his pupils; and not only so, but practising often with such an instrument would give almost equal precision to the performance of those *discords* that occur, and so essentially contribute to the beauties of most compositions, when correctly given, as they are on this organ, but which, it is presumed by the writer, very rarely happens even with our best performers of single parts in concert, for want of any audible phenomenon, like the *beats* of imperfect concords, to exactly fix the point of perfection in a discord while learning to perform, or in practising, as the cessation of beats do for the concords; and, accordingly, he was most forcibly struck on first hearing Mr Liston's organ, with the perfectly new and peculiar character of several of the discords, when heard alone, but more especially when combined in certain chords; the pleasing effect, for instance, of the IIˋ, 7′, IX (and 7′), and what is more surprising, of the ✳ VI, (and ✳ II and IV), when combined, as Mr Liston describes in pages 57, 69, 73 and 99 of his *Essay*, and wherein he mentions also at page 56 (and 99) and 71; the disagreeable effect of 7 (and 5, II and IV) in the dominant seventh, and of 2 in the chord of greater seventh, &c.

To teachers and students of the violin, violincello, &c. the euharmonic organ would prove a valuable guide and test for stopping in tune, particularly with the discords. And, above all, to the theoretic musician and composer this instrument cannot fail of proving at all times useful, for trying the precise effect of every combination of harmony that may suggest itself, and for beneficially extending the bounds of this difficult part of the science. (*ε*)

EVIAN, a town of Switzerland, situated on the south side of the lake of Geneva, about eight or nine leagues from Geneva. It contains two parishes and two convents. About half a league from the town, on the side of Thonon, at the foot of the hill of Amphion, there is a spring of mineral water, which is much frequented in summer. Thirty-six ounces of it contains ½ a grain of iron, ¾ of a grain of selenite, and 6 grains of lime. The banks of the lake of Geneva are here remarkably fine. Not very long ago, carriages could not go any farther east than Evian. In order to reach Meillerie and St Gingoulph, it was necessary to follow a very dangerous footpath along the margin of the lake, and even travellers on horseback, were often obliged to dismount. Since the year 1805, however, a great military road, communicating with the Valais and with the Simplon, has been cut through the rocks, commanding, all the way to St Maurice, a charming view of the Lake of Geneva and of its northern banks. Population of the town 1502. (*w*)

EVIDENCE. See LOGIC.

EVIL, KING'S, is the name formerly given to scrophula, in consequence of its being supposed that the kings of England and France possessed the power of curing this disease by the touch. The English and

French have each contended that this power was first exercised by their respective monarchs; the French asserting that St Louis was first endowed with it, and the English that it was possessed by Edward the Confessor.

In the reign of Charles II. the practice seems to have reached its greatest height; and such were the crowds that flocked to the royal physician, that he is said to have touched more than six thousand persons in one year after his restoration. The demands upon the king's time were so great, that he found it necessary to have the patients examined by his surgeons, for the purpose of determining from their certificates if they were proper objects of compassion. They then received tickets of admission to the royal presence, and were touched by the king on one of the days of healing, either at Whitehall or Windsor. After touching those that were brought to him, the king put about each of their necks a white ribbon, with an angel of gold upon it.

During five years, from 1660 to 1664 inclusive, 23,601 persons were touched by Charles II. and from May 1667 to May 1684, the number amounted to 68,506 making in all 92,107.

See Wiseman's *Chirurgical Treatises,* Book IV. chap. 1. Browne's *Adeno-Cheiradelogia,* or an "anatomick-chirurgical treatise of glandules and strumaes, or king's evil swellings, together with the royal gift of healing or cure thereof, by contact or imposition of hands, performed for above 640 years by our kings of England, continued with their admirable effects and miraculous events, and concluded with many wonderful examples of cures by their sacred touch." See also the *Edinburgh Medical and Surgical Journal,* Vol. III. p. 185. (*w*)

EVIL. See Theology.

EULER's Logarithms, for musical calculations, are a series of artificial numbers invented by this author, for expressing musical intervals in their relations decimally to the octave, as unity, forming a set of Binary *Logarithms,* which see. The writer has known a learned student of Euler's famous work on music, wherein these logarithms are used, stopped for want of being able to deduce common logarithms and lengths of strings from M. Euler's numbers affixed to the intervals; not considering, that one constant ratio must obtain between the corresponding logarithms in any two tables of different kinds, and another constant ratio between their reciprocals respectively.

In the present case, the reciprocal logs. (or those which *increase with* the numbers or intervals) of Euler's, and the common log. of the octave, (or ratio $\frac{1}{2}$,) are, 1 and .30103 respectively, nearly: we have only, therefore, to multiply any of Euler's log. by .30103, to obtain nearly its recip. common log. If, for example, the medius semitone, the first of Euler's notes above F, were given, we have .076814 × .30103 = .0231283, whose recip. .9768767 is the common log. near enough for most experimental purposes, and the number answering to this last is .94815, the length of string to the unison 1.

In like manner, if Farey's *artificial commas* were wanted from Euler's logs. since both of these are of the nature of reciprocal logs. the octave being expressed by 612 and 1 in them respectively, we have only to multiply Euler's logs. by 612, to obtain nearly their artificial commas. The last example will stand thus: .076814 × 612 = 47.010168, or 47, as in the schisma column (Σ) of Plate XXX. Vol. II.; and it may be remarked hereon, that whenever the product approaches a whole number, either above or below it, that such whole number is, in general, the proper number of artificial commas sought.

Euler's Scale.

EULER's Scale of musical intervals. It is probable, we think, that M. Euler made the first, though an unsuccessful attempt, at the grand harmonic improvement, (which Mr Liston has lately effected, by his scale of perfect harmony, and his Euharmonic *Organ,* which see), by endeavouring, on a very limited scale, to avoid tempered or imperfect concords, by means of more notes introduced in the octave than the 12 in common use. M. Euler extended these to 24, eight of which new notes were only a *major* comma higher than his notes C♯, D♯, E, F♯, G♯, A, B♭, and B; and four others of them a *minor* comma lower than his notes D, F, G, and C: at the same time, that three notes of his original scale differ from Liston's, viz. C♯, E♭, and B♭, in having the ratios $\frac{24}{25}$, $\frac{64}{75}$, and $\frac{128}{225}$ instead of $\frac{128}{135}$, $\frac{5}{6}$, and $\frac{9}{16}$, which are Liston's notes respectively.

In order to facilitate the labours of those, who, like the gentleman alluded to in the last article, may be desirous of trying, either by calculation or experiment, the effect and extent of this scale in producing perfect harmonics, we have been at the trouble of reducing M. Euler's vingtquatreave scale, from the octave F to f, in which he has published it, to that of C to *c,* in which all musical scales are given in our work; and we have added in the columns of the following Table, the lengths of strings, and number of artificial commas, answering to each of Euler's notes; and in the last column but one, we have set down the notes on Liston's organ, (see the *Phil. Mag.* vol. xxxix. p. 419, or the *Monthly Mag.* vol. xxxvi. p. 217,) whereon the several chords in this system might be tried, and whence these notes might be transferred to a new instrument, if it were thought worth any one's while to make such a one, having a pedal for bringing on the eight acute notes, and another for supplying the four that are minor comma flats, in the place of their respective original notes, as often as they are wanted in performance, in this scale proposed by M. Euler. The last column shews the numeral value of the notes, major and minor, above C.

Euler's Scale, Euler Leonard.

Euler's Notes.	Common Logarithms.	Lengths of Strings.	Artif. Commas.	Liston's Notes.	Numerals.
C	.6989700,0	.50000	612	C	VIII
	.7038749,3	.50568	602	B'※	
	.7216037,0	.52675	566	B'	VII'
B	.7269987,3	.53333	555	B	VII
	.7496324,2	.56187	509	A'※	
C♭	.7550274,5	.56889	498	A※	※VI
	.7727562,2	.59259	462	A'	VI'
A	.7781512,5	.60000	451	A	VI
	.8007849,4	.63210	405	G'※	
G※	.8061799,7	.64000	394	G※	
G	.8239087,4	.66667	358	G	V
	.8288136,6	.67424	348	F'※※	
	.8465424,3	.70233	312	F'※	IV'
F※	.8519374,6	.71111	301	F※	IV
F	.8750612,6	.75000	254	F	4
	.8799661,9	.75852	244	E※	
	.8976949,6	.79012	208	E'	III'
E	.9030899,9	.80000	197	E	III
	.9257236,8	.84280	151	D'※	
D※	.9311187,1	.85333	140	D※	※II
D	.9488474,8	.88889	104	D	II
	.9537524,0	.89898	94	C'※※	
	.9768762,0	.94815	47	C※	I
C※	.9822712,3	.96000	36	C'※	
	.0000000,0	1.00000	0	C	1

The want of minor consonances above C, are very obvious in the above system, which most probably M. Euler never tried any more than the equal temperament, although his name has been often enrolled among the very numerous theoretic recommenders of the Isotonic system. (ρ)

EULER, Leonard, one of the most distinguished mathematicians of the 18th century, was the son of Paul Euler, and Margaret Brucker, and was born at Basle on the 15th of April 1707.

His father, who had been instructed in mathematics by the celebrated James Bernoulli, became pastor of the village of Riechen, near Basle, in the year 1708; and as soon as his son had arrived at the proper age, he instilled into him a fondness for mathematical learning, although he had destined him for the study of theology. He was afterwards sent to the university of Basle, where he was found worthy to receive lessons from John Bernoulli, who was at that time regarded as the first mathematician in Europe. The assiduity and amiable disposition of Euler, soon gained him the particular esteem of that great master, and the friendship of his two sons Daniel and Nicolas Bernoulli, who had already become the disciples and the rivals of their father. John Bernoulli even condescended to give him once every week a particular lesson, for the purpose of explaining the difficulties which he encountered in the course of his studies. Euler had not the good fortune to enjoy long this inestimable advantage. In 1723, he received the degree of Master of Arts; and on this occasion, he obtained great applause by the Latin discourse which he delivered, containing a comparison between the Newtonian and the Cartesian philosophy. At the request of his father, he now began the study of theology; but his attachment to the mathematics was so strong, that his father at last consented to allow him to follow the bent of his own genius.

Nicolas and Daniel Bernoulli having accepted in 1725 of the invitation of Catherine I. to become a member of the Academy of Sciences of St Petersburg, promised at their departure to employ their influence, to procure for Euler an appointment in that city. In the following year they wrote to him, that they had a situation in view for him, and strongly advised him to apply his mathematical knowledge to physiology. Euler immediately attended the lectures of the most eminent medical professors of Basle, and made rapid progress in the study of medicine. His attention, however, was still directed to his favourite pursuits, and he found leisure to compose a dissertation on the *Nature and Propagation of Sound*, and another on the *Masting of Ships*, which was written for the prize proposed by the Academy of Sciences in 1727. As this subject was actually suggested by several members of the Academy, with the view of bringing into notice the talents of M. Bouguer, who had paid particular attention to this subject, and who was then professor of hydrography in the sea-port town of Croisic, it was not likely that Euler, who was destitute of all practical knowledge of the subject, should have succeeded in the competition. Bouguer, of course, carried off the first prize; but Euler obtained what is called the *accessit*, or second prize, an honour of no trivial magnitude, when we consider that he was then only 20 years of age. About this time, Euler was a candidate for the vacant professorship of natural philosophy in the university of Basle; but he had not the good fortune to be elected.

Euler, Leonard,

Daniel and Nicolas Bernoulli used all their influence to procure an appointment for their young friend; and having at last succeeded, they requested him to repair immediately to St Petersburg. Euler lost no time in obeying this welcome summons; but, after he had begun his journey, he had the mortification to learn that Nicolas Bernoulli had fallen a victim to the severity of the climate; and the very day upon which he entered the Russian territory, was that of the death of the Empress Catherine I.: an event which at first threatened the dissolution of the Academy, of which she had laid the foundation. Having reached St Petersburg at this unfortunate period, Euler resolved to enter into the Russian navy, and had actually received the promise of a lieutenancy and rapid promotion from Admiral Sievers; but fortunately for geometry, a change took place in the aspect of public affairs in 1730, and Euler obtained the situation of Professor of Natural Philosophy. In 1733 he succeeded Daniel Bernoulli, when that illustrious mathematician retired into the country; and in the same year he married Mademoiselle Gsell, a Swiss lady, and the daughter of a painter, whom Peter the Great had carried into Russia upon his return from his first tour. In 1735, a very intricate problem having been proposed by the Academy of St Petersburg, Euler completed the solution of it in three days; but the exertion of his mind had been so violent, that it threw him into a fever, which endangered his life, and deprived him of the use of one of his eyes. In 1738, the Academy of Sciences at Paris crowned his memoir, entitled, *Sur la Nature et les Propriétés du feu*, and in 1740, he divided with Daniel Bernoulli, and our countryman Colin Maclaurin, the prize given by the same Academy, for the best dissertation on the flux and reflux of the sea. Daniel Bernoulli had treated the subject with a sagacity and method which characterized all his labours. The dissertation of Maclaurin contained his celebrated theorem on the equilibrium of elliptical spheroids; and that of Euler contained an improvement on the integral calculus, which seemed to resolve the fundamental equation of almost all the great problems on the motions of the heavenly bodies.

In consequence of an invitation from the King of Prussia, through his minister the Count de Mardefeld, Euler quitted St Petersburg, and went to Berlin in the month of June 1741. Upon his arrival, he was honoured with a letter from the King of Prussia, written from his camp of Reichenbach, and he was soon after presented to the queen-mother, a princess who took great pleasure in the conversation of illustrious men. She treated Euler with the utmost familiarity; but never being able to draw him into any conversation but that of monosyllables, she one day asked him why he did not wish to speak to her? "Madam," replied Euler, "it is because I have just come from a country where every person who speaks is hanged."

The memoirs and works with which Euler enriched mathematics and physics are so extremely numerous, that it would occupy many of our pages to give even the briefest account of them. We shall, therefore, content ourselves with referring the reader to the articles ACHROMATIC TELESCOPES, ALGEBRA, ARITHMETIC *of Sines*, ASTRONOMY, FLUXIONS, MECHANICS, and, in short, to almost every article in mathematics and physics which occurs in our work. A full account of Euler's discoveries and investigations will be found in these articles, and it would only be a waste of time to resume these subjects under the present head. In many of his physical memoirs, Euler has been justly reproached for having applied the calculus to the most unfounded physical hypotheses, or to metaphysical principles, which had not been sufficiently examined; and on this account many of his memoirs have no value whatever, except in so far as they exhibit fine specimens of the resources of analysis. His Dissertations on Wind Mills, on Achromatic Telescopes, on Naval Architecture, and on Gunnery, are among the number of those which are liable to this criticism.

When Euler was at Berlin, the Princess of Anhalt Dessau, the niece of the King of Prussia, was desirous to receive from him some instruction in the different branches of natural philosophy; and for her use he drew up a work, entitled, *Lettres a une Princesse d'Allemagne*, which was translated into English by the late Dr Henry Hunter, and which, with the exception of the metaphysical part, has always been much esteemed particularly for the singular perspicuity with which its author has explained some of the most profound truths in physics. The King of Prussia often employed Euler in calculations relative to the mint, and other objects of finance, in the conducting of the waters of San Souci, and in the examination of canals, and other public works.

In 1744, Euler was appointed director of the mathematical class of the academy, and in the same year he obtained the prize offered by the Academy of Sciences of Paris, for the best work on the theory of magnetism.

About this time Robin's Treatise on Gunnery had appeared in England, and though our countryman had treated Euler with great severity, this act of injustice did not prevent him from recommending it to the king of Prussia, as the best book on the subject. He even translated it, and in the additions which he made, he gave a complete theory of the motion of projectiles. M. Turgot ordered this work to be translated into French, and introduced into the schools of artillery; and about the same time there appeared a splendid edition of it in England.

In 1746, he published his new Theory of Light and Colours, and in 1759, his memoir *Sur les effets du Roulis et du Tangage*, gained the prize offered by the French Academy of Sciences.

In 1750, Euler went to Frankfort to receive his mother, who was then a widow, and to conduct her to Berlin, where she remained till the time of her death in 1761; having enjoyed for 11 years the assiduous attentions of a favourite son, and the high pleasure of seeing him universally esteemed and admired.

When Euler remained at Berlin, he formed an intimate acquaintance with M. De Maupertuis, the learned President of the Prussian Academy of Sciences, and he defended Maupertuis's celebrated and favourite principle of the least action, by resolving by means of it some of the most difficult problems in mechanics. In the dispute into which he was thus led with Koenig, who had attacked Maupertuis in 1751, he lost for a while his usual serenity, and became one of the enemies of that unfortunate individual.

Although the number of foreign associates in the French Academy of Sciences was limited to eight, yet Euler was appointed to the ninth place in 1755, on the condition that no appointment should take place at the first vacancy.

In the year 1760, the Russian army under General Tottleben penetrated into the Marche of Brandenburg, and pillaged a farm which Euler possessed near Charlottenberg. As soon as the Russian general was informed of the event, he immediately repaired the loss by a very large sum; and upon giving notice of the circumstance to the Empress Elizabeth, she added to this indemnity a present of four thousand florins. This act of generosity, no doubt, had a powerful effect in attaching Euler to the Russian government, which, in spite of his absence, had always paid him the pension which it granted him in 1742. Having received an invitation from the Empress Catherine, he obtained permission from the King of Prussia to return to St Petersburg to spend the remainder of his days; but his eldest son was not allowed to accompany him. When Euler was on the eve of his departure, Prince Czartorisky invited him, in the name of the king of Poland, to take the road of Warsaw, where, loaded with kindness, he spent 10 days with Stanislaus, who afterwards honoured him with his correspondence.

Shortly after his arrival in St Petersburg, on the 17th July 1766, he lost the sight of his other eye, having been for a considerable time obliged to perform his calculations with large characters, traced with chalk upon a slate. His pupils and his children copied his calculations, and wrote all his memoirs while Euler dictated to them. To one of his servants, who was quite ignorant of mathematical knowledge, he dictated his *Elements of Algebra*, a work of very great merit, which has been translated into the English and many other languages. Euler now acquired the rare faculty of carrying on in his mind the most complicated analytical and arithmetical calculations; and M. d'Alembert, when he saw him at Berlin, was astonished at some examples of this kind which occurred in their conversation. With the design of instructing his grandchildren in the extraction of roots, he formed a table of the six first powers of all numbers, from 1 to 100, and he recollected them with the utmost accuracy. Two of his pupils having computed to the 17th term, a complicated converging series, their results differed one unit in the fiftieth cypher; and an appeal being made to Euler, he went over the calculation in his mind, and his decision was found correct.

His principal amusement, after he lost his sight, was to make artificial loadstones, and to give lessons on mathematics to one of his grand-children, who seemed to evince a taste for the science.

In 1771, a dreadful fire broke out in St Petersburg, and reached the house of Euler. M. Grimm, a native of Basle, having learned the danger in which his illustrious countrymen was placed, threw himself among the flames, and, reaching Euler's apartment, brought him off on his shoulders, at the risk of his life. His library, however, and his furniture, were consumed, but by the activity of Count Orloff, his MSS. were saved.

Having revised the lunar theory with the aid of his son, and of Krafft and Lexell, he constructed a set of new lunar tables, which appeared in 1772. These tables were, at the suggestion of Turgot, rewarded by the Board of Longitude in France; and when the more perfect tables of Mayer obtained the great premium of three thousand pounds offered by the British Parliament, the sum of three hundred pounds was given to Euler for having furnished the theorems made use of by Mayer in his theory.

In the year 1773, Euler published, at St Petersburg, his great work on the construction and management of vessels. A new edition soon afterwards appeared at Paris, and at the desire of the French king, it was introduced into the schools of Marine, and a reward of 1000 rubles transmitted to the author, accompanied by a handsome letter from the celebrated Turgot. About the same time an Italian, an English, and a Russian translation of it appeared, and the Russian government presented Euler with a gift of 2000 rubles.

Three of Euler's memoirs on the Inequalities in the motions of the Planets, were crowned by the French Academy of Sciences, and he also gained the prizes of 1770 and 1772, by his perfection of the lunar theory.

Having lost his first wife, by whom he had thirteen children, eight of whom died in early life, he was married a second time in 1776, to Mademoiselle Gsell, the aunt of his first wife.

Euler underwent the operation of couching, which was attended with the happy result of restoring his sight; but whether from the negligence of his surgeon, or from his being too eager to avail himself of his new organs, he again lost his sight, and suffered much severe pain from the relapse. His love for science, however, continued unabated, and in the course of seven years, he transmitted 70 memoirs to the Academy of St Petersburg. On the 7th of September 1783, after having amused himself with calculating upon a slate the laws of the ascensional motion of balloons, which, at that time, occupied the attention of philosophers, he dined with his relation M. Lexell, and spoke of the planet Herschel, and of the calculations by which its orbit was determined. A short time afterwards, he was amusing himself with one of his grand-children, when, on a sudden, his pipe fell from his hand, and he expired of an apoplectic stroke, in the 76th year of his age.

Euler left behind him three sons, having lost his two daughters in the latter years of his life. Twenty-six out of thirty of his grand-children were alive at the time of his death.

After a long life, so successfully devoted to the sciences, Euler's reputation was very widely extended. Besides being a foreign member of the Academy of Sciences at Paris, he was a Fellow of the Royal Society of London, and he had received from most of the Princes of the North, with whom he was well acquainted, the most flattering marks of their esteem. When the Prince Royal of Prussia visited St Petersburg, he anticipated the visit of Euler, and passed several hours at the bedside of this great man, holding him all the time by the hand, and having, at the same time, upon his knee, one of Euler's grand-children, who had displayed a premature attachment to geometry. The death of Euler was considered as a public loss even in the country where he lived; and the Academy of St Petersburg decreed to him, at their own expence, a marble bust, which was placed in their public hall. In an allegorical picture which the Academy had put up during his life, Geometry was represented as placed upon a basement covered with calculations. These calculations were the formulæ of Euler's Theory of the Lunar Motions.

Euler's knowledge was not limited to mathematics and the physical sciences. He had carefully studied anatomy, chemistry, and botany, and he was also deeply versed in ancient literature. He could repeat the Æneid from the beginning to the end, and he could even tell the first and last lines in every page of the edition which he used. In one of his works there is a learned memoir on a question in mechanics, of which, as he himself informs us, a verse of the Æneid gave him the first idea.

Euler possessed naturally a strong constitution; and when we consider the nature of his studies, and the assiduity with which he pursued them, we cannot fail to be surprised at the great degree of health which he enjoyed. In all his habits he was sober and temperate, in his manners unaffected and pleasing, and in his temper lively and chearful. In his moral and religious character there is much to admire. The high fame which he acquired, and the interruptions which he must have experienced both at Berlin and St Petersburg, never induced him to abandon the religious duties to which he had been educated. As long as he preserved his sight, he assembled the whole of his family every evening, and read a chapter of the Bible, which he accompanied with an exhortation. Theology was one of his favourite studies, and his doctrines were the most rigid doctrines of Calvinism, the only system of religious truth which a philosopher can maintain.

The following is a list of the principal works which Euler published in a separate form. His papers which appeared in the Memoirs of the Academies of Berlin and St Petersburg, are extremely numerous; and he left behind him no fewer than 200 ready for publication, in order to fulfil a promise which he had made to Count Orloff, to supply memoirs for the *Acta Petropolitana* for 20 years after his death.

Dissertatio Physica de Sono. Basle, 1727.

Mechanica sive motus scientia analytice exposita. Petropoli, 1736, 2 vols.

Tentamen novæ theoriæ musicæ. Petrop. 1739. This work contains many new views; but as M. Fuss remarks, it had no great success, as it contained too much geometry for musicians, and too much music for geometers.

Methodus inveniendi lineas curvas maximi minimive proprietate gaudentes. Lausannæ, 1744, 4to.

Introductio in Analysin Infinitorum. Lausannæ, 1744, 2 vols. 4to. This work, which had become very scarce, was reprinted at Lyons in 1797. It was translated into French in 1796, by J. B. Labey, and published at Paris.

Theoria motuum planetarum et cometarum. Berolini, 1744.

Opuscula varii argumenti. Berolini, 1746, 1750, 1751, 3 vols. in 4to. The tables of the sun and moon, which are sometimes to be found separately, form part of the 1st volume of this collection. As the three volumes make only 600 pages, they are generally found in one.

Scientia navalis, seu tractatus de construendis ac dirigendis navibus. Petropoli, 1749, 2 vols. 4to.

Theoria motuum Lunæ exhibens omnes corporum inequalitates cum additamento. Berolini, 1753, 4to.

Dissertatio de principio minimæ actionis, una cum examine objectionum Cl. Koenigii, contra hoc principium factarum. Berolini, 1753, 4to.

Institutiones calculi differentialis, cum ejus usu in analysi infinitorum ac doctrina serierum. Berolini, 1755. Another edition of this work was published in 1787, in 2 vols. 4to, and another at St Petersburg in 1804, in 2 vols. 4to.

Constructio lentium objectivarum ex duplici vitro. Petrop. 1762.

Meditationes de perturbatione motus cometarum ab attractione planetarum orta. Petrop. 1762, 4to.

Theoria motus corporum solidorum seu rigidorum. Rostochii, 1765, 4to.

Institutiones Calculi Integralis. Petrop. 1768—1770, 3 vols. 4to. Another edition, more correct, was published at Petersburg in 1792 and 1794, in four vols. 4to.

Dioptrica. Petrop. 1769, 1771, 3 vols. quarto.

Novæ Tabulæ Lunares singulari methodo constructæ. Petrop. 1772, 8vo.

Opuscula Analytica. Petrop. 1783, 1785, 2 vols. 4to.

Lettres a une Princesse d'Allemagne sur quelques sujets de Physique et de Philosophie. Petersburg, 1768, 1772, 3 vols. 8vo. Another edition of this was published at Berne in 1778, in 3 vols. 8vo. An edition was published in Paris, with notes by Condorcet, and another in 1812, by J. B. Lobey.

Elemens d'Algebre trad. de l'Allemand, par J. Bernoulli, avec des notes par Lagrange et Garnier. Paris, 1807, 2 vols. 8vo. Two editions of this work were published at Lyons in 1774, and 1796, and an edition appeared in London translated into English.

Theorie complete de la construction et de la manœuvre des vaisseaux, (le style retouché par Keralio.) Paris 1776, 8vo. The original edition of this work appeared at St Petersburg in 1773.

A collection of the best productions of Euler appeared at Brienne in 1797, in 18 volumes.

A more extended list of the writings of this illustrious mathematician, will be found in his Elogé by Nicholas Fuss, which was published at St Petersburg, in 1783, in 4to. (β)

EVOCATION, is the name of a religious ceremony which was always observed by the Romans, when they began the siege of a town, and which they considered as necessary to their success. It consisted in calling upon the gods and goddesses of the place to forsake the town and come over to them. See Macrobius, *Sat.* iii. 9. (*w*)

EVOLUTES. See Fluxions.

EVOLUTION. See the articles Algebra, and Arithmetic.

EVORA, or Elvora, formerly *Ebora,* and the *Liberalitas Julia* of Julius Cæsar, is a city of Portugal, and the principal town in the province of Alemtejo. It is the see of an archbishop, a corregidor, a providor, a juiz, &c. Evora is situated upon a gentle eminence, in a fruitful plain, in the centre of the province, and is surrounded by hills. It consists of narrow crooked streets full of angles, and is distinguished from almost every other town in the kingdom, by its high Gothic buildings, and a number of old Gothic churches. The houses are in general small and low. The cathedral church is situated in the highest part of the town, and has 25 prebends, each of whom enjoys an annual income of 5000 crusades. The archbishop's house adjoins the cathedral, and not far from it are the shambles, an old Roman building, in which admirably preserved Corinthian columns are connected by a plaster wall. These columns, seven in number, are remarkably beautiful, and a drawing of them has been given by Murphy. It is said to be the remains of a temple of Diana. Before it was converted into the shambles, it had been used by the Moors as a mosque. In the great square, and in other parts of the town, there are many other remains of Roman architecture. On the north side, the aqueduct enters the town. It was begun by Sertorius, but was entirely rebuilt by John III. When Mr Link visited this town, a large and massive edifice was building for barracks, which, when finished, will, he supposes, be unique in its kind in Portugal.

Evora was formerly the seat of an university, but it has totally fallen into decay since the time of Pombal. There are no manufactures, and no trade in the town. It contains five parish churches and 23 religious houses. It is defended by twelve bastions, and two demi-bastions. "On the north side of Evora," says Mr Link, "the hills rise, being round the town, adorned with gardens, and on their summits with evergreen oaks. The road from hence to Montemor o Novo, which is five leagues distant, passes over granite hills, partly covered with corn fields and partly with fine woods of evergreen, oaks, and pastures, which give great variety to the prospect." Population 12,000. West Long. 7° 42', and North Lat. 38° 30'. See Link's *Travels in Portugal,* p. 471. (*w*)

Its name whence derived.

EUPHRATES, or more properly called the *Phrat,* from the Hebrew *Phar,* or *Pharatz,* to spread, and *Pharah,* to produce fruit or flowers; a river of Asia, which, with the Tigris, forms the western boundary of the Persian empire.

Its sources.

The Euphrates has two principal sources in the mountains of Armenia; the first of these is called Alla, issuing from a mountain in the vicinity of the towns of Bayazid and Diadin, and receives in its course the tribute of six springs from Shehrian, Malasjird, Khunnoos, Chaharbore, Miznajird, and Kague. The second is formed by the confluence of many streams from the mountains around Erzeroom; and is called the Karasu, from the blackness of its water.

Its course.

These two streams pursue a westerly direction, and unite near the town of Kebban, in the recesses of Mount Taurus, when the river inclines to the south-west, and passes within a few miles of the walls of Malatea. Receiving at Malatea another tributary stream, it approaches the Mediterranean, till it is forced into a south-east course by the mountains in the neighbourhood of Samosata. Though not so rapid, the Euphrates is a much finer river than the Tigris; while the latter at Argunna is but a little brook, the Euphrates is 100 yards broad at Malatea, and at Ul Der, or the ancient Thapsacus, 800. Ten miles from the village of Lemloon, situated about half way between Bussora and Hillah, its waters are diffused over an immense morass, and are again collected about 21 miles north of Samavat. These marshes have been much increased since 1784, when the Great Soliman Pasha threw a bank across the river at Delvania, to divert the course of the river into an old channel, for the purpose of attacking with advantage the Alghasil Arabs. At Korna, about 130 miles distant from its mouth, the Euphrates joins the Tigris; their united streams receive the name of the Shat ool Arab, and form one of the noblest rivers in the East. The force of the flood-tide prevails so much at Korna, that, from the point of the triangle formed by the junction of the two rivers, it is seen flowing up the Euphrates on the one hand, and forced back by the strength of the Tigris on the other. Korna is one of the three Apameas built by Seleucus, in honour of his first wife Apama, and is situated at the point of a triangle, formed by the confluence of these two streams. Sir John Malcolm, sent as ambassador from India to the court of Persia by the Marquis Wellesley, considering the position of Korna peculiarly advantageous, and where an impregnable fort might be erected at a trifling expence, which would secure the navigation of both rivers, repress the inroads of the neighbouring Arabs, and command the countries between Bagdad and Bussora, recommended this object as worthy of the attention of the governor-general of India. Here the channels of the Euphrates and Tigris are so deep, that a small ship of war might anchor close to the works, and a canal cut across the base of the triangle, from one river to the other, would render any other fortification unnecessary.

Advantageous position of Korna.

Remark of Polybius.

Polybius observes, that the Euphrates is remarkable for differing in one respect from most others in the world. Rivers, in general, he remarks, increase in size as they advance in their course, their waters swelling in winter and decreasing in summer. The Euphrates, on the contrary, diminishes as it flows, is very high in the middle of summer, and no where so broad as in Syria. This is accounted for from its increase being the effect of the dissolution of snows in the mountains, and not of winter rains; canals and reservoirs being employed to draw off the superabundant waters for irrigating the districts on its banks, it decreases as it traverses an extent of country.

Captain M. Kinneir, author of a Geographical Memoir of the Persian Empire, who must be supposed the safest authority to follow, writing from actual observation on the spot, and to whom we are indebted for much interesting information on this subject, says, that the greatest rise of the Euphrates is in January, when it attains an increase of 12 feet perpendicular; and it continues to rise and fall till the end of May or beginning of June. Here is a manifest contradiction of Polybius, which we cannot hope to reconcile, as it probably proceeds from some change, in the manner in which the river is now affected, unknown to us. However, in justice to Polybius, who is esteemed an excellent historian, and drew from the best sources within his reach, we must observe that that part of his account where he mentions that the Euphrates decreases in size as it advances in its course, is supported by Kinneir; for this author states that at Hillah, near the ancient Babylon, the Euphrates is only 200 paces broad, and 40 feet deep. Now Hillah is much below Ul Der, where it is 800 yards broad. Perhaps the great depth of 40 feet may be thought to compensate in some degree the breadth so much higher up; but we are not warranted to draw this conclusion, as Kinneir has not given us the depth of the river at Ul Der. Even in the driest season, the Euphrates is navigable for boats of considerable burden, up as far as Shukashu, a village situated on the west bank of the river, and a day's sail from Korna. The tides of the Persian Gulf reach 20 or 25 miles above Korna; and the river is navigated, during six months of the year, by flat bottomed boats up to Hillah. These boats are of a singular construction. The body resembles a half-moon in shape; the ribs and planks are roughly nailed together, and the outside covered with naphtha or bitumen; there is no keel, and the rudder, formed of a number of spars clumsily bound together, is nearly as large as the vessel; the rigging consists of one mast and a lateen sail. When proceeding to Bussora, they float down the stream; on their return, they are tracked up against the current. Another kind of boat, perfectly round, made of wicker work, covered with bitumen, and about seven feet in diameter, called a Kufa, is much used on the Euphrates and Tigris. Herodotus mentions circular boats made of reeds, in the form of a shield; and, as Captain Kinneir remarks, it is curious to observe that so little alteration in their construction has taken place during such a lapse of ages.

Polybius contradicted by Kinneir.

Description of boats on the river.

Canals and artificial lakes.

No subject has excited more the attention of the learned than the river Euphrates, with regard to its great canals and artificial lakes, dug for the reception of its waters at the season of inundation. Of the ancient authorities, Arrian is the most explicit, and who, Dr Vincent in his learned work on the voyage of Nearchus, says, possesses the peculiar felicity of rising in estimation in proportion to the attention paid to his relations, the purity of the sources whence he drew, having been established by subsequent discovery and investigation. The canal of Pallacopas, dug by the first of the Babylonian kings, is still in existence; but, since the desertion of Kufa, having fallen into disrepair, about twenty years ago it was partially cleared by the Nabob of Oude, in honour of whom the Arabs now call it Hindi. It is cut from the right bank of the Euphrates, and that part of it which still holds water, extends to within five miles of the city of Meshed Ali, or Nejiff. The remainder is nearly choked up with sand, but its course may be traced from the Bahr Nejiff, or Sea of Nejiff, to the town of Zobeir, and to its termination at the Khore Abdallah in the Persian Gulf. In the neighbourhood of Babylon are still the remains of two lakes, celebrated by the names of Ali and his son Hussein. The upper lake lies nearly on the parallel of Babylon: At its northern extremity stands the town of Kerbela, containing the tomb of Hussein, the grandson of Mahommed. From the southern extremity of this lake to the northern point of the lower, or Bahr Nejiff, the distance is about twenty-five miles. Meshed Ali is situated a little to the east. Into this lower lake the Euphrates was turned by the canal of Pallacopas, at the season of its floods. The opening and shutting of this canal was a part of the office of the satrap of Babylon; and, as Dr Vincent remarks, it must have been a duty of the highest importance, in a tract of country where all is desert that cannot be watered, and every spot fertile that can be flooded.

Pallacopas canal.

When Babylon was the capital of the East, the command of the waters of the Euphrates was highly necessary for the cultivation of the adjacent districts; and thus, as the cities in the vicinity of its banks have flourished or decayed, its canals and dikes have been preserved or neglected. And though its grand canals have failed, the ruinous policy of the Turks, at this day, regards the partial distribution of its waters as an object of primary importance for the purpose of irrigation. Arrian gives us the following account of the origin and object of the canal of Pallacopas, cut from the Euphrates to draw off its superabundant waters. For this river, he tells us, descending from the mountains of Armenia, flows within its natural channel during winter, but receives such an accession of water in the beginning of spring, and a still greater about the summer solstice, that, overflowing its banks, it lays under water the plains of Assyria. And unless this inundation, caused by the dissolution of snows in the mountains,

Arrian's count of Pallacop

were diffused by means of the cut of Pallacopas over lakes and marshes, the whole of the surrounding country would be desolated. The waters thus drawn off, reach the main by a diversity of subterraneous courses. Though the Euphrates again decreases after the dissolution and discharge of the snows, yet so great a part of its waters flow through the Pallacopas, that had not means been adopted to bank up this channel, and confine the river within its natural limits, the whole Euphrates would probably discharge itself in this direction, and refuse its waters to irrigate and fertilise the plains of Assyria. On this account the Satrap of Babylon, at a great expence of labour, cut off the communication, although the work, on being completed, was found to be insufficient; the embankment being composed of mud and such like materials, was incapable of resisting the pressure of the water, and continued to yield it a passage through the canal. Alexander, consulting the advantage of Assyria, shut out the waters by a more solid and permanent work. At a short distance, a rocky soil was found, which, when cut through, and prolonged to the Pallacopas, offered the double advantage of conducting the superabundant waters, without injury to its banks, and of affording a good foundation for the constructing of works and sluices to admit the waters of the Euphrates at its season of inundation, and to exclude them effectually when the floods had subsided, and when it became necessary to confine the river within its natural channel, for the cultivation of Assyria. Alexander sailed to Pallacopas, falling down the canal into the Bahr Nejiff. Here having fixed upon a convenient spot, he founded a city, defended by walls. Thus far we follow Arrian.

This city long retained the name of Alexandria, after that of its founder, but on its becoming the residence of a dynasty of Arabian princes, was changed to that of Hira. It is now known by the name of Nejiff or Meshed Ali, and is supplied with water by a subterraneous aqueduct, connected with the cut of Pallacopas. This the Wahabee, in order to distress the city, broke down, so that when Captain Kinneir was at Meshed Ali, in 1808, the inhabitants of the town were obliged to bring their water in sheep skins, from a distance of three or four miles.

The Bahr Nejiff, or sea of Nejiff, (the Rahemah of D'Anville) is of equal antiquity with the Pallacopas, and a work of infinite labour. The above mentioned gentleman passed through the middle of it, in his way from Samavat to Meshed Ali, and found it dry, with the exception of a few ravines and channels of water, near which the poorer classes rear rice and vegetables. There are other canals which deserve notice. Of these, the canal of Kerbela, or Nahr Sares, now called Husseini, at the extremity of which is the large and populous town of Kerbela, or Meshed Hussein, is a very fine one, though more ancient than the days of Alexander, and supposed at one time to have been connected with the Bahr Nejiff. Of the canal of Isa, which is said to have commenced at Is, the modern Hit, and to have terminated at Opis, connecting the Euphrates and Tigris, not a trace now remains. The only canal at present communicating with the two rivers, is called the Hie. It cuts the Jezira exactly half way between Bussora and Bagdad, and in spring is navigable for large boats.

At the small town of Hit, which furnished the bitumen of which the walls of Babylon were built, a bridge of boats is thrown across the Euphrates, for the convenience of the caravans of Bagdad and Aleppo. There is a bridge of 15 arches at the town of Argish, three days journey from Van, situated on the north-west side of the lake of the same name, which is about 168 miles in circumference, but whose water is so brackish as to be unfit for use.

Babylon divided by the Euphrates.

It is well known that the Euphrates divided the city of Babylon into two equal parts, flowing through it from north to south. Its banks were faced with bricks, the inhabitants descending by steps to the water, through small brass gates in a lofty wall, parallel with the river. Semiramis threw across a bridge of five furlongs in length, and 30 feet in breadth, to connect the two quarters of the city, and erected a palace at each end of the bridge. These palaces communicated with each other, by means of a vaulted passage cut under the bed of the river, for which purpose an immense lake was dug, into which its waters were turned. The course of the river, Kinneir remarks, might easily be diverted, as the banks of the Euphrates rise above the level of the adjoining plain; but, as he adds, it is difficult to conceive how it could be confined within the compass of an artificial lake, without inundating the surrounding country, or forcing a passage to the sea. The waters of the Euphrates were again diverted by Cyrus, when he took Babylon. Taking advantage of a great festival held in the city, and when all its inhabitants were immersed in debauchery and revelling, he posted a part of his troops, destined for the attack, on that side where the Euphrates entered the town, and another division on the side whence it issued out, giving orders that they should enter the city by marching along the bed of the river, as soon as they found it fordable. In the evening, he caused the great receptacles and canals above and below the town to be opened. By this means the Euphrates was discharged, and its natural channel left dry. The enterprise was greatly facilitated, and, perhaps, solely accomplished, in consequence of the negligence and disorder of the city, as that night the gates of brass which shut up the avenues from the river to the town were left open.

Waters of the Euphrates diverted.

Pyramid of Nimrood.

When Kinneir examined the ruins of Babylon, he mentions particularly a pyramid, six miles south-west of Hillah, called Nimrood by the Arabs, about 50 feet in height, from whose summit the windings of the Euphrates may be traced through the level plain of Shinar. Villages and orchards are seen to line its banks, while a few hamlets, interspersed here and there on the desert, appear like spots on the surface of the ocean. Though the Euphrates flows through one of the most productive regions of the earth, the pernicious policy of the Turk renders unavailing the bounty of nature, the baneful influence of despotism converting fertile plains into sterility, and the habitation of wild beasts. On those banks where once flourished the proudest cities of the world, now languish comparatively insignificant towns; where luxury and abundance were universally diffused, a scanty pittance is now gathered; and where mighty conquerors have contended for kingdoms, the wandering Arab of the desert now vindicates his spoil. But the whole extent of country along the banks of the Euphrates must not be included in this picture of desolation. The description of Armenia, through considerable part of which this river flows, appeared so delightful to the imagination of poetry, that Milton has fixed here the terrestrial seat of paradise.

……………Eden stretch'd her line
From Auran, eastward to the royal towers

> Of great Seleucia, built by Grecian kings,
> Or where the sons of Eden long before
> Dwelt in Telassar.
>
> *Par. Lost.* Book IV.

The borders of the Euphrates between Korna and Shukashu produce dry grain in abundance, and the territory of the Alghazil Arabs, a low marshy tract, formed by the expansion of its waters between Lemloon and Samavat, is celebrated for its crops of rice. There is an excellent breed of horses on the banks of this river, in the district inhabited by the tribe of Montefidge, great numbers of which have lately been exported to India, by Mr Manesty, the British resident at Bussora. A very high bred horse, however, is difficult to be procured, even at Bagdad or Bussora, and will fetch from 1200 to 3000 piastres, or from about L. 120 to L. 300 sterling.

Mouth of the Euphrates.

In noticing the mouth of the Euphrates, we shall attend chiefly to what Kinneir says on the subject. This has given occasion to a great deal of discussion. Dr Vincent has bestowed much pains and argument in elucidating the matter, and D'Anville has been led into gross mistakes, from ignorance on some particular points of inquiry. But Kinneir having been encamped for six months on the banks of the Karoon and Hafar, must be supposed, from his intelligence, and opportunity of investigation, eminently qualified to give correct information, and to settle disputed points.

It has generally, though erroneously, been supposed, that the Shat-ool-Arab, (the combined stream of the Euphrates and Tigris,) enters the Persian Gulf by a variety of mouths. This mistake has probably arisen from the ignorance of navigators, about the rivers of Susiana, concluding that the seven channels which issue from the Delta into the sea, at no great distance from each other, were derived from the Shat-ool-Arab, the river with which they were chiefly acquainted. These channels, or khores as they are called, in Mr Cluer's map preserve the following order: Cossisa Bouny, Bamishere, Karoon, Seluge, Mohilla, Goban, and Deria Bona. If it be proved that the Bamishere, the next in succession, as well as in magnitude, to the Cossisa Bouny, or Shat-ool-Arab, is not in the least augmented by the waters of the latter, clearly none of the others can; for the only means of communication is by the Hafar cut. Now, the Bamishere is the main stream of the Karoon. This river, after its confluence with the Abzal at Bundikeil, contains perhaps a greater body of water than either the Euphrates or Tigris separately. This stream, on reaching Sabla, a ruined village 30 miles east of Bussora, disunites; the largest branch called Hafar, after a course of fourteen or fifteen miles, again separates. The greatest portion of waters flowing obliquely to the east, constitute the Bamishere, and the rest enter the Shat-ool-Arab, through an artificial cut, three miles long. This cut is the only communication which the Shat-ool-Arab has with the six eastern channels; and as the waters of the Karoon constantly flow through it into that river, not those of the Shat-ool-Arab into the Karoon, it is evident that neither the Bamishere, nor the other Khores, are derived from the combined stream of the Euphrates and Tigris, which, on approaching the Gulf, receives the name of the Cossisa Bouny.

The Euphrates, according to Arrian and Strabo, entered the Persian Gulf by a separate channel, afterwards obstructed and turned by the citizens of Orchoe. This opinion has been acquiesced in by D'Anville. Vincent, however, thinks this erroneous, and tries to prove that the Pallacopas canal passing near the city of Orchoe, and entering the gulf in the Khore Abdallah, was mistaken by the ancients for the mouth of the Euphrates. The five remaining channels are ramifications of the Karoon, which takes an easterly direction towards the Delta of Goban, on separating from the main stream of the Sabla. Before Sheikh Solyman raised his bund, or embankment, at Sabla, the Bamishere was the channel usually navigated by ships bound to Bussora. They passed through the Hafar cut, which is at least 150 yards wide, and, at high water, deep enough to admit a vessel of any size.

Nearchus sailed up the Euphrates.

Nearchus, on his voyage from the Indus to the Euphrates, entering the channel called by Arrian, Pasitigris, now known by the name of the Karoon, conducted his fleet up to Susa, and thence descending with a division of his ships through the Hafar cut, which thus appears to be of greater antiquity than the days of Alexander, passed into the Shat ool Arab. Some ships, commanded by Nearchus in person, sailed up the Euphrates as far as Babylon. At Babylon the death of Alexander terminated the further prosecution of an enterprise, which extended to the circumnavigation of Arabia, up the Red Sea to Suez. A plan worthy of the comprehensive genius of the illustrious projector of a voyage, which must be considered as the most interesting in the world, at the time of its accomplishment, opening a communication with Europe and the most distant regions of Asia, and, as Dr Vincent observes, the source and origin of the Portuguese discoveries, and the primary cause, however remote, of the British establishments in India.

From its source, the Euphrates performs a course of about 1400 miles to its confluence with the Tigris at Korna, which, estimating at the distance of 130 miles from the Persian Gulf, the waters of the Euphrates consequently flow upwards of 1500 miles in reaching the sea.

See Kinneir's *Geographical Memoir of the Persian Empire, passim,* and the accompanying Map; *Memoire sur l'Euphrate et le Tigre par D'Anville;* Vincent's *Voyage of Nearchus,* and *Arrian's Hist.* by Gronovius (W. T.)

EURIPIDES, a celebrated Grecian tragic poet, was born in the first year of the 75th Olympiad, (about 468 B. C.) in the island of Salamis, whither his parents had retired, a short time previous to the invasion of Attica by Xerxes. In consequence of the false interpretation of an equivocal oracle, he was destined, by his father, for the profession of an athletic champion; but his own natural genius soon directed him to very different pursuits. He is said to have studied rhetoric under Prodicus, natural philosophy under Anaxagoras, and morals under Socrates. This last, however, although affirmed by various authors, appears to be a mistake; for, upon a reference to chronology, it will be found, that Socrates was twelve or thirteen years younger than Euripides; which makes it very improbable that the latter could have stood in the relation of pupil to the former. But it is pretty certain, that a great friendship and intimacy subsisted between these two eminent men; in so much that Socrates, who in general disapproved of dramatic exhibitions, seldom appeared at the theatre, unless when the tragedies of Euripides were to be performed.

At an early age, Euripides imbibed a strong partiality for the study of philosophy; but perceiving the dangers and persecutions to which those exposed themselves, who ventured to combat vulgar prejudices, and to controvert the popular opinions, he was induced to abandon his favourite pursuits, and devoted himself, from his eighteenth year, to the composition of dramatic poetry, in which he soon rose to the highest eminence. He wrote a great number of tragedies, which were held in the highest estimation during his own time, and have been admired by the best scholars and most learned critics of all ages. He was the contemporary and rival of Sophocles, with whom he repeatedly contested the palm of superiority in the composition of tragic poetry. Like many of the great men of that age, he experienced the biting ridicule of the celebrated comic writer Aristophanes; and, in consequence of the sarcasms of that formidable wit, it is said he resolved to withdraw from Athens to the court of Archelaus of Macedon, a great patron of learned men, by whom he was hospitably received, and raised to high honours. Here, however, he met with a most tragical fate; for, while he was walking in a wood, according to his custom, absorbed in profound meditation, he was encountered and torn to pieces by the prince's dogs, who happened to be at that time engaged in hunting. Archelaus lamented his death, and gave him a magnificent funeral. When the news of his fate reached Athens, the inhabitants were so grieved at the event, that the whole city went into mourning. His great rival Sophocles, with a soul superior to vulgar jealousy, also manifested his grief in the most unequivocal manner. He ordered a tragedy to be performed upon the occasion, at which he himself and the actors appeared in deep mourning. The circumstances of the death of Euripides, however, are variously reported; but we have given the most current tradition regarding it; and the event seems to have happened when he was about 75 years of age.

Euripides is said to have been the author of ninety-two tragedies, of which nineteen still remain. His performances seldom gained the prize; yet they were much esteemed by the Greeks, and so highly venerated among the Sicilians, that when the Athenian army, commanded by Nicias, was defeated in Sicily, the soldiers purchased their lives and liberties by reciting the verses of Euripides. His plays abound so much in moral sentences, and philosophical maxims, that he was called the philosopher of the stage. By many, he has been considered as the most accomplished of all the ancient tragic poets, although the critics are divided in their opinions concerning the superior claims of Æschylus, Sophocles, and the subject of this article. Quintilian seems unwilling to decide, yet he evidently gives the palm to Euripides, (*Inst. Or.* lib. x. cap. 1.) He is inferior to the two first, perhaps, in majesty, sublimity, and force; but he is generally allowed to surpass them in morality and pathos; and in the declamatory eloquence of the stage he is probably unrivalled. Aristotle calls him the most tragical of all the poets.

Euripides introduced some improvements into the composition of tragedy. Among other changes, he suppressed the prologue, in which it had been usual to give an outline of the story, and threw the exposition of the subject into the piece itself; a mode of proceeding, which, although it presented some difficulties to the author, was of considerable advantage to the dramatic art.

The manners of Euripides were harsh, and his character austere; but his dramatic productions, in general, do not indicate such dispositions; for there is no poet who has written with greater feeling and tenderness, or who has described the passion of love in more expressive and delicate terms. He is said, however, to have had two wives, whose character and conduct were far from contributing to soften the asperity of his temper; and he acquired the name of the *woman hater*, probably in consequence of the many invectives which, in his writings, he pointed against the fair sex.

The earliest edition of Euripides is that of Aldus Manutius, Venice, 1503, 8vo. It contains only the Greek text of eighteen tragedies. This edition was renewed by Hervagius, Basil, 1537, &c. Robert Winter published another edition at Basil, in 1541, with a Latin version. John Oporin printed an edition of Euripides, in Greek and Latin, 1562, fol. Plantinus gave an edition at Antwerp, 1571, 16mo, with the division and arrangement of the verses by William Canter. Besides these, we have the edition of Jerome Commelin, Heidelberg, 1597, 8vo; of Paul Stevens, 1604, 4to; and of Joshua Barnes, Cambridge, 1694, fol. with a life prefixed, and learned notes. Some tragedies have been printed separately, and commented upon, by different editors. The excellent English translation of Euripides by Potter, is well known. (*z*)

EUROPE.

Europe is the name given to one of the four great divisions into which geographers have divided the earth. Though much the smallest, it is by far the most important and powerful, and indeed governs almost all the others. In the warmth of its climate, the fertility of its soil, and the richness and luxuriance of its productions, Europe is perhaps the least favoured quarter of the world. But in the political strength and greatness of the nations which inhabit it, in civilization and refinement, in attainments in science, and in all the useful and ornamental arts, the superiority is vast and striking. Here is the theatre on which the human character has appeared to the greatest advantage, and where society has attained its most perfect form, both in ancient and modern times; and this smallest portion of the globe, seems destined to extend knowledge and improvement over the rest of the world.

The origin of the name *Europe* is not certainly known; but it seems to have been extended from that of a small district on the European side of the Hellespont, as the name of Asia spread from the name of the country on the opposite shore. The extent of this part of the globe, which yields considerably even to Africa, is from the most western point of Portugal near Lisbon, to the Uralian mountains on the east, in length about 3300 British miles, and in breadth, from the North Cape in Lapland to the southern extremity of Greece, about 2350. The contents in square miles, though they cannot be calculated with any degree of accuracy, may be stated at the medial number of two millions and a half. The ancients were but very imperfectly acquainted with the boundaries of Europe. A great proportion of this division, especially in the north and east, has never been known with any degree of precision until modern times. It is bounded on the north by the Arctic Ocean, or Frozen Sea; on the west by the Atlantic Ocean; and on the south by the Mediterranean Sea. Its eastern limits are not so well defined. As the natural boundaries on this side extend only a certain length, it is separated from Asia in many places merely by arbitrary li-

Extent.

Boundaries.

mits. The line which divides these two quarters of the globe, is generally understood, however, to proceed along the Uralian mountains, down the small river Karporka, the great river Don, and through the Sea of Azof, the Black Sea, the Hellespont, the Sea of Marmora, and the Dardanelles into the Mediterranean.

Divisions. There are in Europe no great natural divisions, unless we consider it as divided by the Baltic into the countries north and south of that sea. On the north of the Baltic, are the northern or Scandinavian kingdoms, Denmark, Norway, and Sweden. The extensive empire of Russia, occupies the remainder of the north and all the east of Europe. In the south, is the European part of the Turkish empire, and the Italian states. In the west, proceeding from south to north, are the kingdoms of Spain and Portugal, France, Holland, and part of Germany. And in the centre of Europe are situated most of the German states, Prussia, Poland, Switzerland, Bohemia, Hungary, &c. During the violent and extraordinary convulsions which for the last twenty years have agitated and desolated this division of the globe, it has often been difficult to say what were the limits, or who were the masters of many of its states and kingdoms; but now that the storm has subsided, they are again returning to nearly their former boundaries, their former governments, and their former institutions.

Islands. The European islands are numerous, and some of them extensive and highly important. **Azores.** On the west in the Atlantic Ocean, are the Azores, situated about thirteen degrees west of Cape St Vincent in Portugal. Though frequently classed under Africa, they more properly belong to Europe, to which they are nearer, from which they were peopled, and to which they have always been subject. **British isles.** The British isles, consisting of Great Britain and Ireland, with the numerous circumjacent islands belonging to them, the seat of the greatest and most powerful empire on the face of the earth. **Faroe isles.** The Faroe islands, belonging to the crown of Denmark. **Iceland.** The large and celebrated island of Iceland, subject to the same power, lying about 400 miles from the continent in the Western Ocean; and numerous other but unimportant islands on the Norwegian coast. **In the North Sea.** In the great Northern Sea, the chief and most extensive are the remote and dreary and almost uninhabited islands of Nova Zembla and Spitzbergen. **In the Baltic.** In the Baltic Sea, are the islands of Denmark, Zealand, the chief seat of the Danish monarchy, Funen, Laland, Talster, Bornholm, &c.; the islands of Rugen, Oeland, Gothland, and Aland, belonging to Sweden; and those of Cronstadt, Oesal, Dago, &c. subject to Russia. **In the Mediterranean.** In the Mediterranean, are the islands of Majorca and Minorca, of Corsica and Sardinia, the large and fertile island of Sicily, Malta, Candia the ancient Crete, Negropont the ancient Eubœa, with the numerous other islands of the Grecian Archipelago.

Peninsulas. Europe contains numerous peninsulas. Some of its finest and most celebrated regions are peninsular. Besides innumerable others of lesser extent and importance, we may notice Crim-Tartary in the Black Sea; the peninsulas of Greece and of Italy in the Mediterranean; Spain and Portugal, contained between the Mediterranean and the Atlantic; and Jutland, formed by the Atlantic and the Baltic. We may include also Scandinavia, which is only a large peninsula formed by the Baltic and the Northern Ocean.

Mountains. The mountains of Europe do not form ridges of such vast extent as those of Asia, and are much inferior in height to those in Thibet and in South America. Of the European mountains, the Alps undoubtedly hold the first place. They extend, in a kind of semicircular form, from the Gulf of Genoa, through Switzerland, which contains their centre and highest parts, and terminate in the Carnic Alps, on the north of the Adriatic Sea—a length of about 550 British miles. Mount Blanc, the highest point of the Alpine chain, and the greatest elevation of the ancient continent, rises 15,662 feet above the level of the sea. **Pyrenees.** Next to the Alps are the Pyrenees, which divide France from Spain, extending between the Atlantic and the Mediterranean. Mont Perdu, which is considered as the highest elevation of the Pyrenees, ascends above the level of the sea about 11,000 feet. **Scandinavian chain.** Between Norway and Sweden runs the extensive Scandinavian chain, known by distinct appellations as it passes through different provinces. The elevation of these mountains have not been very accurately ascertained; but they do not equal the Alps, or even the Pyrenees. **Carpathian mountains.** The grand and extensive ridge of the Carpathian mountains extends, in a semicircular form, from the mountain of Javornick, south of Silesia, bounds Hungary on the north and east, and sends off branches to Transylvania and Wallachia. Its whole circuit may be about 500 miles; and the highest summits of these mountains do not exceed 8000 or 9000 feet. **Hæmus.** On the south of the Danube, in Turkey, runs the grand range of the Hæmus, stretching from Eminch to the south of Servia, a tract of 400 miles, known under various names. From the western extremity of the Hæmus branch off two other extensive chains, one running between Dalmatia and Bosnia; the other passing south, and forming the mountains of Albania on the west of Greece. **Appenines.** The Appenines, branching off from the Alps near Ormea, separate the plains of Piedmont from the sea, and stretch, in one extensive and uninterrupted chain, through the whole length of Italy to its farthest extremities. **Volcanoes.** Of the volcanic mountains of Europe, mount Ætna, in Sicily, claims the first distinction. The other volcanoes are those of mount Vesuvius near Naples, and mount Hecla in Iceland. The islands of Lipari, to the north of Sicily, also contain many volcanoes, of which Stromboli is the chief. The European mountains which we have enumerated, with various others of inferior importance, will be more minutely described under their own names, or under the different countries to which they belong.

Seas. On the west of Europe flows the great Atlantic Ocean, which separates it from the new continent of America. **Atlantic.** To different parts of this sea local names have been given, from the coasts washed by its waves: As the German Sea, flowing between Great Britain and the opposite shores of Germany and Denmark; the British Channel, between the south of England and the coast of France; St George's Channel and the Irish Sea, between Great Britain and Ireland; the Bay of Biscay, between France and Spain, &c. On the European coasts of the Atlantic Ocean are various extensive banks or shoals, the resort of cod and other fish, which prove a useful source of industry and subsistence to the inhabitants. **Arctic S** To the north of Europe lies the Arctic Ocean, extending over the polar regions, the dreary and solitary abode of cold and of ice; yet even this enormous and apparently barren waste furnishes a fertile source of provisions for the human race. Here the vast and innumerable tribes of herrings find a retreat from their numerous foes, and breed their millions in security. About the middle of winter they come forth from their retreat, and spread themselves in three divisions. One directs its course westward, and reaches the shores of America; another smaller squadron passes through the Straits of Beering, and visits the north-eastern coasts of Asia. The principal division reaches Iceland about the beginning of March, in a close shoal of surprising depth, and of such extent, that its surface is supposed to equal the dimensions of Great Britain and Ireland. They are afterwards, however, subdivided into numerous smaller columns of five or six miles in length, and three or four in breadth, which arrive during spring and summer on different parts of the north-western coasts of Europe. The whale fisheries, too, which these northern seas supply, is another source of considerable wealth to various of the European nations.

Inland seas.

In surveying the continent of Europe, one of its most striking and important features, is the number and extent of its inland seas; which have been justly regarded as one of the chief causes of its industry and civilisation, and consequent superiority to the other grand divisions of the globe. Amongst these, the Mediterranean is obviously pre-eminent. From its shores, their first seats, both in ancient and modern times, knowledge and civilisation have been diffused over the other countries of Europe. From the Pillars of Hercules, on the west where it communicates with the Atlantic, it penetrates between the continents of Europe and Africa, as far east as Syria in Asia, a length of 2090 miles, by a breadth of between 400 and 500. On the European side, open two large inlets, the Gulf of Venice and the Archipelago, which still further extend the advantages of inland navigation, which the Mediterranean so eminently affords. The wide expanse of this sea is beautifully sprinkled with islands, and environed with opulent coasts, abounding with the most sublime and picturesque features of nature. In the Mediterranean there are no tides, except in the narrowest straits; but a current sets along the Italian shore from west to east, and towards the African in an opposite direction. This sea abounds in fish. The chief fisheries are those of the tunny, of the sword-fish, of the sea-dog, and of the anchovy. To the north of the eastern part of this sea, which is denominated the Levant, but distant from it some hundreds of miles, lies the Black Sea, with which it communicates by two narrow straits, and the small sea of Marmora, which is situated between them. This extensive sea, of which the western parts only belong to Europe, is said to have derived its name from its black rocks, or dangerous navigation. To the north of the Black Sea, and connected with it by the short and narrow strait of Caffa, is the sea of Azof, the utmost maritime limit of Europe in this quarter. It is shallow, and polluted with mud, whence its ancient name of *Palus Meotis*.

Amongst the inland seas of Europe, the Baltic holds the second place. This extensive inlet opens from the German Sea by a gulf, in the direction of N. E. called the *Skager Rack*, and afterwards turns to the south, in what is called the *Cattegat*. The Baltic then spreads widely to the N. E. and is divided into two extensive branches, called the Gulfs of Bothnia and Finland, both covered with ice during four or five months of the winter. The greatest depth of this sea does not exceed 50 fathoms; and the Swedish naturalists say that it loses about four feet in extent in the course of a century. Its waters do not contain above 1-30th part of salt, whereas other sea-water often holds a tenth. There are no tides, and the fish are few.

The only other great inland sea of Europe is that called the White Sea, which is an extensive inlet or gulf of the Arctic Ocean, penetrating the northern provinces of Russia in the direction of the Baltic. This sea was better known before the commerce of Archangel was supplanted by that of St Petersburgh.

The numerous and extensive inland seas and gulfs of Europe, give rise to several celebrated straits. Of these, besides those already mentioned, the most important are, the Straits of Gibraltar, which connect the Mediterranean with the Atlantic Ocean; the Straits of Messina, between Italy and Sicily; the Dardanelles, between the Grecian Archipelago and the Sea of Marmora; and the Hellespont, between the Sea of Marmora and the Black Sea; the Straits of Dover, which connect the English Channel with the German Sea, and the narrowest distance between the English and French coasts; and, in the Baltic, the celebrated Strait of the Sound, between the Island of Zealand and the coast of Sweden, where the king of Denmark levies a toll on all ships passing up and down the Baltic; the Great Belt, between Zealand and Funen; and the Little Belt, between Funen and the peninsula of Jutland.

Europe contains few or no lakes of any great extent. The most considerable are, the lakes of Constance, 45 miles in length, and 15 in breadth; and of Geneva, 40 miles long, and nine at its greatest breadth, both situated in Switzerland. The lakes, Wenner, 80 miles in length, and 50 in breadth; Wetter, about 80 miles long, and 12 broad; and Mœler, 60 miles by 18, in Sweden. And Lake Onega, which is about 150 miles in length, by a medial breadth of about 30; and the Ladoga, 130 miles long by 70 in breadth, in the western divisions of the Russian empire.

The more limited extent of Europe admits not the accumulation of such mighty bodies of water as the Asiatic and American continents roll to the ocean. The largest and most important of the European rivers, are, the Volga, the greater part of which belongs to this division of the globe. This largest of the European rivers takes its rise in the mountains of Vaklay, between Petersburgh and Moscow, and, after running in a south-easterly direction, a course of upwards of 1700 miles, falls into the Caspian at Astracan. This noble river, having no cataracts, and few shoals, is navigable even as high as Tver. Its chief tributary streams are, Kama on the east, and Oka on the west.

Next to Volga is the Danube, whose magnificent stream rises in Swabia, and passing through Bavaria, Austria, Hungary, and Turkey, falls into the Black Sea, after a circuit of 1300 miles. The Danube, though occasionally impeded by small falls and whirlpools, is yet navigable through an immense extent of its course. The Dnieper, or ancient Borysthenes, rises in the government of Smolensk, about 150 miles to the south of the source of the Volga, and after a course of about 1000 miles through fertile provinces, falls into the Euxine Sea. The Rhine rises in the mountains of Switzerland, and falls into the German Sea, by several mouths, on the coast of Holland. This noble river, whose banks are celebrated for their grand and striking scenery, forms the great barrier between France and Germany, and its course may be computed at 600 British miles. It receives, near Mentz, the tributary stream of the Mayne. The Elbe rises in the Sudetic mountains of Silesia, and, running through the north of Germany a course of 500 miles, discharges itself into the sea near Cuxhaven. The Don rises from a lake in the government of Tulan, and falls into the sea of Asof, after a course of about 800 miles. The Dniester forms the boundary between European Turkey and Russia, derives its source from the north side of the Carpathian mountains, and falls into the Euxine at Akerman, after a course of about 600 miles. **Dvina.** The Dvina and Pelchora direct their course to the Arctic Ocean. The course of the former, which falls into the White Sea, is about 500 miles; and that of the latter 450. The Dvina rises in the province of Smolensk in Russia, and falls into the Baltic at Riga, after running 500 miles. **Vistula.** The Vistula rises in the Carpathian mountains, passes Warsaw, and joins the sea near Dantzic, after a course of 450 miles. **Oder.** The Oder has its source in the mountains of Moravia, and, after watering Silesia, Brandenberg, and Pomerania, joins the Baltic, after a course of 380 miles. **Rhone.** The Rhone springs from the Glacier of Furca, and, flowing through the Lake of Geneva, bends its course to the south, and enters the Mediterranean; its course is 400 miles. **Loire.** The Loire rises in Languedoc, and after running 500 miles, enters the ocean beyond Nantes. **Seine.** The beautiful stream of the Seine, on which the city of Paris is built, falls into the English Channel at Havre de Grace, after a course of 250 miles. **Ebro.** The Ebro rises in the mountains of Asturias in Spain, and after a south-easterly course of 350 miles, falls into the Mediterranean Sea. **Tagus.** The Tagus has its source in the west of Arragon, and holding a course of 450 miles, falls into the Atlantic at Lisbon. **Thames.** Nor in enumerating the rivers of Europe, ought we to forget the Thames, which, though one of the smallest, is one of the most celebrated; the seat of British empire, and the grand resort of the commerce of the world.

Climate. Excepting a small portion of its most northern limits which stretches within the Arctic circle, Europe is entirely situated within the temperate zone, and is consequently exempted from the utmost extremities both of heat and of cold. In so extensive a track, however, the climate must necessarily be very various. While its northern states are often cold and bleak, and during many months lay bound in the frozen chains of winter, one wide expanse of snow, its central regions are generally mild and temperate, and its southern kingdoms enjoy a sky the most serene, and a climate the purest and most delightful in the world. The climate of no division of the globe is more salubrious than that of almost every part of Europe; and nowhere do the human species live to a more advanced age. **Soil.** The soil of Europe, though it pours not forth its vegetation with the same spontaneous luxuriance as in regions heated by a tropical sun, yet, aided by the hand of industry, and superior skill in agriculture, it supplies more certainly and more abundantly than any other quarter of the earth, subsistence for its numerous population, and furnishes them with all the comforts and even luxuries of life.

Population. The population of Europe is estimated at 150,000,000 of souls; which is about one-fifth of the whole population of the globe. The Europeans excel both in vigour of body and in energy and activity of mind; and so far has their progress in knowledge and arts raised them above the inhabitants of the other divisions, that they almost seem to be a superior race. There can be no doubt that in Asia were the primeval seats of the human race, from whence they diffused themselves over the rest of the world. The time and circumstances of their first migrations into Europe, history has not with certainty recorded. The most ancient population of this quarter of the earth which we can trace, consisted of the Celts in the west and south; the Fins in the north-east; and the Laplanders, a diminutive race like the Samoids of Asia, in the furthest north. Those ancient inhabitants, who seem to have been thinly scattered, were driven towards the west and north by the Scythians or Goths from Asia, whose descendants occupy the greater part of Europe; and by the Sarmatians or Slavonic tribes, also from Asia, the ancestors of the Russians, Poles, &c. From Africa, also, a colony of the Iberi passed into Spain at a very early period; and at a later period, the accession of the Hungarians and Turks took place from Asia.

Political state. The irruptions of these barbarous nations who overran the Roman empire, and settled themselves in every quarter of Europe, gave rise to a new and singular state of society, distinguished by the name of the Feudal System. As these conquerors of Europe had their acquisitions to maintain, not only against such of the ancient inhabitants as they had spared, but also against the more formidable inroads of new invaders, self-defence was their chief care, and seems to have been the chief object of their first institutions and policy. With this view, every soldier, upon receiving a portion of the lands which were divided, bound himself to appear in arms against the enemies of the community. This tenure, by which they held their land, amongst a warlike people, was reckoned both easy and honourable. The king or general who led them to conquest continuing still to be their head, had, of course, the largest portion allotted to him. These lands he parcelled out amongst his adherents, binding those on whom they were bestowed to resort to his standard when required, with a number of men proportioned to the extent of territory they received. His chief officers imitated the example of their sovereign, and in distributing portions of land to their dependants, annexed the same conditions to their grant. Thus a feudal kingdom resembled a military establishment rather than a civil institution. The victorious army, cantoned out in the country which it had conquered, continued arranged under its proper officers, who were ordered to hold themselves in readiness to assemble whenever occasion should require their united operations. The names of a soldier and a freeman were synonymous. Every proprietor, girt with a sword, was ready to march at the summons of his superior, and to take the field against the common enemy. Such is the origin and outline of that celebrated system which for many centuries prevailed throughout the whole of Europe. Though it seems well calculated for repelling foreign assaults, yet it was ill fitted to promote the ends of internal order and tranquillity, and was unfavourable to the cultivation of every art but that of war. By the gradual operation of various causes, this barbarous structure has been overthrown in most of the states of Europe. In some countries, however, considerable remains of it are still to be found, and in all its former existence, may be traced in their laws, policy, and institutions.

In Europe, almost alone, or in its colonies, are liberty and free government to be found. In various states, freedom is established beyond the reach of accident or caprice; and even those governments which in theory are more arbitrary or altogether absolute, the diffusion of knowledge, the state of European society and manners, and the force of public opinion, has rendered in practice comparatively mild, and attentive to justice and the rights of the subject: The universal hatred and detestation of which, in this quarter of the world, where the principles of freedom and of government are so much better understood, they invariably render their authors the objects, in a great measure check such wanton exertions of tyranny as occur under Oriental despotisms. The operation of these causes is extended, and the administration of its different governments in some degree assimilated, by that close and intimate union subsisting amongst its various states, which is peculiar to modern Europe. In ancient times, and in other divisions of the globe, every independent state is unconnected and detached. It looks on an inactive spectator, while one of its neighbours is overrunning and conquering another, and interferes not, unless for the defence or extension of its own territories or dominion. In this state of things, some one individual power is always acquiring an undue preponderance and ascendency fatal to the independence of the rest; and the face of the political world is perpetually undergoing great and sudden changes. But the similarity in the situation of the European powers; the resemblance of their languages, manners, and laws; the extension of their intercourse by travelling and foreign residence; their union, by the relations of scientific and commercial pursuits, the universality of the Christian religion, and a conviction of the great and common advantages of such an union,—have given birth to an intimate connection in times of peace, and a common feeling of interest in maintaining the existence of the present state of affairs. They form a united whole within themselves, almost separated from the rest of the world,—a great federacy, acknowledging indeed no common chief, but united by certain common principles, and obeying one system of international law. Each power views with solicitude the dangers which beset the rest, and feels itself attacked when any of the weaker states are exposed to the insults or oppressions of their more formidable neighbours. The power that would encroach on the territories of any one feeble neighbour, must lay its account with preserving the usurpation, by exposing its whole dominions and colonies to the combined attacks of the other states, who will immediately unite to restore the former balance of power.

Such is the system of political equilibrium which exists in this quarter of the globe, though an impolitic ambition, or thoughtless security, has frequently prevented its full application to the affairs of modern Europe. We may easily perceive, however, how great has been its influence in maintaining the independence of the different states, if we consider the trifling extent of the changes which have taken place in the relative situations of the European powers, and the distribution of the Continent under separate governments during the long period of modern history. Thus in Europe has been formed a species of general law, which, in most instances, supersedes an appeal to the sword, by rendering such an appeal fatal to any power that may infringe upon the code; by sending the forces of the rest invariably against each delinquent; by agreeing that any project of violating a neighbour's integrity shall be prevented or avenged, not according to the resources of their neighbour, but according to the full resources of every other member of the European community, and by constantly watching over the state of public affairs, even in profound peace. Such is the balancing system carried to its full extent; and such is the state of refinement to which it is constantly tending.

The time, it is probable, is approaching, when the affairs of Europe, like those of a great commonwealth, shall be settled, not in the field of battle, but in a general congress of deputies from its various states; and any of its nations waging war be regarded as guilty of rebellion; to quell which, all the rest are bound to contribute their aid. But as civil wars will often take place, and sometimes succeed in overturning the governments which they attack, so commotions will also take place in the European community, and may even be of such a nature and strength, as to endanger or even altogether overturn the general confederacy. Of this kind were the late dreadful and alarming convulsions which for a time completely suspended, and seemed to have entirely destroyed, the balance of power in this part of the world. But its different kingdoms having again subsided into their ancient state, after one of the severest agitations to which they can ever be exposed, has established this system much more firmly than if it had never been interrupted; and shewn, that no power need hereafter attempt to disturb it, who is not able to subjugate Europe.

Political state.

Religious state.

The Christian is the universal religion of Europe, with the exception of Turkey, in which Mahometanism is established, but where, nevertheless, at least one half of the inhabitants are Christians. And its religion must be regarded as one of the causes of the superiority of Europe; for wherever the religion of Jesus has penetrated, knowledge, industry, and civilization, have followed. The southern parts of Europe were converted to the Christian faith at an early period. Among the barbarous tribes of the North, the progress was slow. Scandinavia remained Pagan till the eleventh century; some Sclavonic tribes on the South of the Baltic till the thirteenth; and it is not above a century since the Laplanders were converted by missions from Denmark. The chief divisions of the Christian church are three: The Greek church, which prevails in Europe, and the two grand distinctions of Catholics and Protestants; the former of which are prevalent in the South, and the latter in the North of Europe.

Progressive geography.

The progressive geography of Europe will be more properly and more minutely illustrated under the descriptions of its different kingdoms and states. Spain, France, and Britain, were early and fully explored by the Romans, who overrun them with their arms, and established in them permanent settlements. Their ships explored the southern shores of the Baltic, as far as the river Rubo, or the Western Dvina, and discovered the names of several tribes along the coasts; they were also acquainted with the southern parts on the left of the Danube, but of the central parts of Germany it is evident, from the maps of Ptolemy, they had no just ideas. Of Scandinavia, the ancients knew only the southern parts, as far as the lakes Wetter and Wenner. The Carpathian or Sarmatian mountains were well known, but the line of 50° or 52° north latitude bounded the ancient knowledge in the north-east, and the wide extent of the Russian empire continued almost unknown to Europe until the sixteenth century. The greater and more splendid efforts, indeed, for extending geographical knowledge, have been directed to distant regions; but great and laudable exertions have also been made to improve the geography of European nations. Some of them have already been most minutely and elaborately described; and it is probable, from the great and increasing intercourse amongst its different states, as well as the labours of scientific and public spirited individuals, every fact of importance in the geography of Europe will speedily be unfolded. (*t*) exchange of Liverpool takes the lead of both these celebrated places of mercantile resort, in the same manner that the different public rooms of Liverpool are superior to those of any other city in Britain. The hours of meeting on 'Change have, like our hours of dining, experienced a considerable alteration in the course of the present age; and, notwithstanding the endeavours made in London to enforce adherence to established rules, by shutting, at a given hour, all the gates except one, it has become more and more fashionable to protract the transactions of business beyond four o'clock, so that it is now generally near five before the Exchange is completely cleared.

Exchange between different countries.

II. Exchange, taken in the sense of paying or receiving money between two countries, forms one of the most complicated subjects of political economy. The discrepancies of public opinion, in this respect, have been strongly exemplified by the recent discussions on the bullion question. All parties were agreed in regard to the practical point of the fall of exchange, but the cause and the manner of its taking place are, to this day, subjects of doubt to many persons, possessed, in other respects, of considerable information. The bullionists contend that the fall was owing to the excess and consequent depreciation of our paper currency; while the mercantile body maintain that it arose from the magnitude of our foreign expenditure, and the unfavourable balance of our trade with the continent. Under the head BULLION we have taken occasion to state, that the point appeared to us to lie in the middle, but more on the side of the commercial advocates. That our paper currency has undergone a partial depreciation, to the extent of two or three per cent. can hardly be doubted, on comparing our tables of the prices of gold and silver, since the year 1800; for at no time since that period, have bank notes been within three per cent. of the value of silver. On the other hand, the enormous fall of the continental exchange since 1808, is to be attributed much more to commercial and political causes, than to over issues of paper currency. The stoppage of the American trade to the continent of Europe, has always appeared to us the fundamental root of the evil. It deprived us at once of a remittance of four or five millions a year, which came over in weekly packets, in portions of L. 50,000 or L. 100,000, with as much regularity as the letters which passed by these vessels. War had had no effect in diminishing this most important supply, until it was thought expedient to lay, by our orders in council, an interdict on the commercial intercourse between the United States and Europe. It happened unluckily, that soon after trying this unprecedented experiment, the commencement of the war in Spain called for extraordinary supplies from this country. The absence of American traders making it necessary for us to effect our remittances in specie, we were speedily stripped of our bullion; and our deficient crop in 1809, obliging us to import large quantities of corn, led, in the next instance, to a deprivation of our current coin.

The bullion question might have been much simplified, had the parties who spoke and wrote on it been familiar with the principles of exchange. These will be most easily comprehended, by dividing exchange into three heads, *real*, *nominal*, and *computed*.

Real exchange.

Real exchange.—By this head is meant a reference to actual value, without taking any account of the apparent difference arising from the variety in the money denominations of different countries. The exchange from one city to another in the same kingdom, from Glasgow to London, for example, is abundantly simple. An allowance of interest for 30, 40, or 45 days, is granted in consideration of the superior value of money in the metropolis; and no farther difference exists, as the currency of the two cities is uniform. A striking example this of the tendency of exchange to approach to a state of equality. In the same manner, two countries trading with each other, though necessarily subject to somewhat greater fluctuations than two provinces of the same empire, discover, in fact, much more of apparent than real difference in the point of exchange. The object of all trade is to exchange the commodities of one place for those of another; and merchants have no interest in creating in any place an inequality in the value of money. Equality of imports and exports leads to corresponding equality of debts and credits, and money being thus of the same value in one place as in another, the course of exchange is consequently at par. It not unfrequently happens, however, that circumstances occur sufficiently general in their operation, to unsettle this the natural state of things. A deficient crop in one country, leads to an importation of corn beyond the amount which can conveniently be balanced by exported commodities; and the result is, a balance in favour of the country which has sold the corn. In that country, money becomes of somewhat more value than in the debtor country, because the object of the latter is to get it conveyed thither, in order either to procure further supplies, or to discharge the debt which has been incurred. Specie is accordingly sent thither, as soon as the difference of value in the two countries becomes such as to defray the cost of its transport. As it lies in very small compass, the chief expence of its transportation by sea, is its insurance, the rate of which is, in time of war, necessarily affected by the hazard of capture. In some cases, though very rarely, the edicts prohibiting intercourse and interchange of specie, create an additional burden on the traffic. Such prohibitions are so ineffectual, and so unnecessary, that we should not have adverted to them, had not the experience of the present age shewn, that there still exist governments so backward as to lay stress on them as a part of its code of regulations.

The stock of coin in a particular country, being no more than is requisite for the transactions of current business, it seldom happens that much of it can be sent abroad. Bullion is therefore the more frequent resource; and the want of bullion leads naturally to the purchase of it from countries such as Spain, or Spanish America, where it forms a principal article of export. During our late years of pecuniary distress, we have imported, in surprising quantities, the metallic treasures of the Spanish Main; but their possession has been very transient, the military contest in the peninsula, and afterwards in the north of Europe, having operated as immediate and complete absorbents. India even has been made to furnish supplies of gold and silver, the latter probably for the first time, as she has been making annual drains of silver from Europe and America during several centuries. Like the specie of the West, the importations from India found a speedy vent on the continent, and paper has continued the only currency of this country. Until the late stoppage of neutral trade, a British commissary on a foreign station was accustomed to apply for specie, not to government at home, but to the merchant, generally American, who imported the chief supply of goods into the place of his residence. He gave the American a bill on London, and received in return the current money which the latter had obtained for the sale of his nerchandise. The American remitted his London bill o a mercantile correspondent, like Messrs Barings, vho paid it away, by order of the owner, to persons xporting manufactures to the United States. The reult accordingly was, that the manufacturers in Yorkhire or Lancashire were actually the contributors of he funds required for our continental expenditure, vhether the latter were wanted in the Mediterranean, he Baltic, or the central part of Europe.

Were governments to avoid expensive foreign armanents, the course of exchange would experience comaratively little fluctuation. In itself, it has a steady endency to approximate to a level; for no sooner does noney become of more value in one country than anoher, than it is the interest of the merchant to send oods to the spot in question. Intelligence of the reative prices of commodities is transmitted from counry to country by every post, and no men are more exert in making shipments, whenever a rise of price afords a tolerable chance of advantage. These shipnents are continued until prices are brought to a level; circumstance which can hardly happen until the exhange has been equalized. Any species of merchanise may thus be made instrumental in contributing to ring things to the desired level. Bullion has, morever, the advantage of general currency, and is conseuently resorted to as the readiest instrument for moothing the inequalities of exchange. Being saleble every where, and subject to no loss by retention, xcept the loss of interest, it is particularly calculated or the purpose in question, so soon as the difference of xchange between two countries becomes such as to pay or its transmission. The exportation of it takes place ither in bars, as imported from the mining districts, or n metallic pieces formed out of coin melted down or the purpose of concealment. Almost all governnents have been desirous of prohibiting the export of heir current coin, and all have been unsuccessful in the ttempt. The process of melting is too short and too asy to be restrained by law; so that the chief result of he prohibitory edicts has been an enhancement of the alue of the transmuted metal in proportion to the risk ncurred in the evasion. This process, however, is unecessary in this country, in regard to foreign coin, Spaish dollars for example, which being exempt from retriction in point of export, often form a large part of he specie sent abroad for mercantile and political puroses. Our laws do not aim at keeping all kinds of oin within the limits of the kingdom; they are directd only to the retention of our own currency.

Nominal exchange. We are now to leave the consieration of the actual effects of trade, and to direct our ttention to the distinctions created by artificial differnces in the state of currencies. It is common to speak f a *par* of exchange between two countries, by which meant "that sum in the currency of either, which ontains the same value of gold or silver as a given um of the currency of the other." In former years eleen guilders of Holland were equal to a pound sterling, nd whenever our pound was above or below that andard in Dutch money, the exchange with Holland as accounted so much above or below par.

Differences in exchange frequently exist without uch real inequality in the value of specie between the ne place and the other, and these are commonly called *ominal.* In times when civilization had made less rogress, and the true policy of countries was little unerstood, it was not uncommon for the sovereign to *dease* the quality of the coin. A more recent, and somewhat less violent, act of injustice, was the reduction of its weight. In France, irregularities of the latter description took place about a century ago, and in Turkey they have occurred even during the present generation. The obvious effect of this diminution of value, must be a reduction of the nominal exchange. When the French government, under Louis XV. issued an order that the *ecu*, till then of five francs, should contain silver of the value of four francs only, foreign nations would of course consent to receive it only at the latter rate. In the same way, the value in exchange of the Turkish piastre fell, not many years ago, to the half of its former amount. It deserves to be mentioned, that, in our own case, before the new coinage of 1774, our exchange with the continent was, on account of the lightness of our coin, two or three per cent. below par; but that so soon as we had guineas of the full weight, it regained its proper level.

Another cause of fluctuation, to a certain, though no great extent, in the rate of exchange, is the occasional variation in the *relative* value of gold and silver. In this country, gold is the standard coin; in France, in Holland, and in most parts of the continent, silver is the standard. Now the price of the one compared to the other, though not subject to sudden fluctuation, can by no means be accounted stationary. In a round estimate it was common to set down gold to silver, in the ratio of 15 to 1, but various circumstances may modify the existing proportion. Of late years, the silver mines of America have been in a state of progressive and rapid increase; her gold mines, on the other hand, have become less productive than formerly. The consequence has been a gradual, though not very considerable diminution in the relative value of silver. The practical effect on the exchange is a reduction of those money denominations, of which silver is the standard. This being the case in Dutch money, the par of exchange between Holland and England, is no longer 11, but fully 11½ guilders for the pound sterling. The same applies to other parts of the continent; but the difference being merely nominal, has no influence on the transactions of business.

The introduction of paper currency during the last and present age, into almost every country of Europe, has been productive of great though not of permanent irregularities in the state of the exchange. This way of augmenting currency is by much too seductive to be lodged in the hands of any government. On the Continent, the issues of paper have generally proceeded, not as in this country from banking incorporations, detached in a considerable degree from the influence of the government, but directly from the public offices of the state. The issues have accordingly been pushed as far as the projects of government required, or as the credulity of the public, in a season of enthusiasm, would bear. No account was taken of the proportion to be observed with reference to the demands of trade; and it was quite forgotten that the existing currency is always equal, or nearly equal, to these demands. The history of the French assignats has been repeated, although in a style of less extravagance, in all the principal countries on the Continent. Spain, Portugal, Austria, Russia, and Sweden, have each their royal or imperial bank-notes, which circulate at a great and acknowledged inferiority to the current coin. In France, the exaltation of the popular mind enabled the executive power to make, at a particular time, an enormous abuse of the facility of creating money; but the excess of the evil produced its cure, and there has been, since the year 1796, no paper currency of consequence in that empire. The other nations of the Continent being somewhat less credulous, and their governments less violent than the French, have dealt in more gradual issues, and have continued, to a considerable degree, the use of the degraded currency. Its effect on the state of exchange will be seen in a moment, on comparing the rates now quoted for bills on Russia, Austria, or Sweden, with the rates of former years, when the computations were made exclusively in coin. In our own case, there can remain little doubt that the fall of our exchange relatively to France, Holland, America, and other quarters where the currency is sound, has been the consequence of the non-convertibility of our paper currency. The depression has continued too long to be accounted for by temporary causes. Not that over issues of bank notes produced the fall in the first instance, but the fall once occasioned by the operation of mercantile and political causes, our specie, as we explained under the head of Bullion, was sent abroad, and the substitution of paper at home was the cause of preventing its return. This paper, however undoubted in point of character, is not current on the Continent; it is *not convertible into specie*, and therefore undergoes a considerable fall, when exchanged for the precious metals. On attending to the fluctuations in this respect, we find that our paper has regularly fallen in proportion as demands for subsidies or other purposes increased the sum required on the Continent.

Computed exchange.

Computed exchange.—After describing the exchange, both in its *real* and *nominal* character, the subject may appear to be exhausted; but there remains a third discrimination, known by the name of *computed* exchange. This might be better understood, if it were called the apparent or current rate of exchange, for it means nothing else than the rates as they are quoted in the mercantile letters of the day. Merchants take no account of the causes which operate more or less remotely on the statements of exchange. Their business is with its actual condition; a condition which may be affected by circumstances connected with either the real or the nominal exchange. A sudden demand of corn from the Baltic, may make the real exchange between England and Poland in favour of the latter; while the depreciated paper of Poland, at least of Russian Poland, may produce a calculation apparently favourable to England. This calculation forms, as it stands, the computed or current exchange, and is the only part of the matter noticed in the letters, or attended to in the speculations of merchants.

In describing the nature and effect of inequalities in exchange, a very important question is, whether they are, or are not, productive of actual loss? Some persons imagine that a nominal fall in the value of currency, leaves things nearly as they were, but we have only to analyse the transactions of our own governments with foreign countries, since 1808, to be satisfied that the loss is real and absolute. Our taxes are paid in paper, while a considerable portion of our expenditure must be defrayed in specie. That specie must either be bought up by government at a great loss, or our commissaries in foreign parts must sell bills on the Treasury at a discount which, of late years, has risen from 10 and 15, to 20, 25, and even 30 per cent. The addition thus made to our public expenditure is serious, while, on the other hand, the fall of money has no tendency to produce a counteracting increase of revenue, except in that limited portion of our taxes which are levied on merchandise or property *ad valorem*. In the reign of William III. a similar inequality existed, our exchange with Holland being 25 per cent. below par. This being prior to our adoption of paper currency, was caused by the reduced weight of our silver coin; for at that time, and for 20 years after, silver constituted our money-standard. Our coinage was reformed at a very heavy expence, in the reign of William; and the exchange recovered its level in the same way that it recovered from the comparatively small depression which existed previously to the recoinage of 1774. In Holland, long as she has been a commercial country, the currency has been confined to specie, and more particularly to silver. In the cities, indeed, all great transactions are discharged in cheques; but bank-notes, payable, on our plan, to the bearer, are unknown. Gold ducats are sometimes used, but the major part of cash payments is made in dollars.

Mercantile Calculations of Exchange.

Mercantile calculation of exchange.

The principal trading cities in Europe use the monies of exchange explained in the following Tables.

Hamburgh.

Exchanges are computed in marks, schilling lubs, and pfenings; or in pounds, shillings, and pence, Flemish; also in rixdollars, marks, &c.

12 Pfenings = 1 Schilling lubs.
16 Schillings = 1 Mark.
3 Marks = 1 Rixdollar.
6 Pfenings = 1 Grote or penny Flemish.
12 Grotes = 1 Schilling Flemish.
20 Schillings Flemish = 1 Pound Flemish.
Thus, 6 Schilling lubs = 1 Schilling Flemish.
7½ Marks = 1 Pound Flemish.

There are two sorts of money in Hamburgh, called *banco* and *currency*. Banco bears an agio, or premium against currency, which is generally from 20 to 25 per cent.

Amsterdam.

Exchanges are computed in florins, stivers, and pennings; or in pounds, shillings, and pence Flemish.

16 Pennings = 1 Stiver
20 Stivers = 1 Florin or Guilder.
2 Grotes, or Pence Flemish = 1 Stiver.
12 Grotes or 6 Stivers = 1 Shilling Flemish.
20 Shillings Flemish, or 6 Florins = 1 Pound Flemish.

There are two sorts of money in Holland; namely *bank-money* and *currency*; bank-money generally bears a premium of 2, 3, or 4 per cent. which is called *agio*.

Paris.

Exchanges are computed in francs and centimes; or in livres, sous, and deniers tournois.

100 Centimes = 1 Franc.
12 Deniers = 1 Sou or Sol.
20 Sous = 1 Livre.
80 Francs = 81 Livres.
3 Livres or 3 Francs = 1 Ecu of Exchange.

America.

Exchanges are computed in dollars, dimes, and cents; and in some places in pounds, shillings, and pence currency.

ge.

10 Cents = 1 Dime.
10 Dimes, or 100 Cents = 1 Dollar.
12 Pence currency = 1 Shilling, Ditto.
20 Shillings currency = 1 Pound, Ditto.

In the days of the prosperity of Holland, Amsterdam was the great medium of European exchange. Its central situation, the magnitude of its commerce, and the well known accuracy of Dutch merchants, rendered it a kind of pivot, on which the various exchanges of other countries had a regular tendency to turn. The effect of this convenient and central point was to create a steady inclination towards equality in the bill-transactions of different countries. If it happened that a sudden export of merchandize from one kingdom to another, created an irregularity in the exchange, the medium of Amsterdam was open to modify the extent of the difference, by putting into the balance the bills arising from the transactions of the countries in question with other parts of the world. This complicated question will be best understood, by bestowing attention on the exchange operation commonly known by the name of the "chain rule," or "arbitration of exchanges." This curious and ingenious method proceeds on the principle of lessening the inequality of a direct interchange of bills between any two cities or countries, by adopting a comprehensive and circuitous course. We extract the following explanation from Kelly's Cambist, a work of merit on the subject of which we are treating.

In 1804, Spain was bound to pay to France a large subsidy; and, in order to do this, three direct methods presented themselves:

1. To send dollars to Paris by land.
2. To remit bills of exchange directly to Paris.
3. To authorise Paris to draw directly on Spain.

The first of these methods was tried, but it was found too slow and expensive; and the second and third plans were considered as likely to turn the exchange against Spain. The following method, by circular exchange, was therefore adopted.

A merchant at Paris was appointed to manage the operation, which he thus conducted: He chose London, Amsterdam, Hamburgh, Cadiz, Madrid, and Paris, as the principal hinges on which the operation was to turn, and he engaged correspondents in each of those cities to support the circulation. Madrid and Cadiz were the places in Spain from which remittances were to be made, and dollars, of course, were to be sent where they bore the highest price, for which bills were to be procured on Paris, or on any other places that might be deemed more advantageous.

The principle being thus established, it only remained to regulate the extent of the operation, so as not to issue too much paper on Spain, and to give the circulation as much support as possible from real business. With this view London was chosen as a place to which the operation might be safely directed, as the price of dollars was then high in England: a circumstance which rendered the proportional exchange advantageous to Spain.

The business was commenced at Paris, where the negociation of drafts issued on Hamburgh and Amsterdam served to answer the immediate demands of the state; and orders were transmitted to those places to draw for their reimbursements on London, Madrid, or Cadiz, according as the courses of exchange were most favourable. The proceedings were all conducted with judgment, and attended with considerable success.

The particular mode of calculation will be understood with little difficulty, from the following example.

Suppose £1000 sterling is to be remitted to Cadiz, and the direct exchange is 40*d.* sterling per dollar, but the remitter wishes to send it through Holland and France; it is required to know which is the most advantageous, the direct or indirect remittance, the quotation of the course of exchange being as follows?

London on Amsterdam, 35 schillings or shillings Flemish per pound sterling. Amsterdam on Paris, 60 pence Flemish for the ecu of 3 francs. Paris on Cadiz, 15 francs for 1 doubloon of 4 dollars of exchange.

Statement.

£1000 sterling.
1 Pound sterling = 35 Shillings Flemish.
1 Shilling Flemish = 12 Pence Flemish.
60 Pence Flemish = 3 Francs.
15 Francs = 1 Doubloon.
1 Doubloon = 4 Dollars.

$$\text{Hence } \frac{1000\times35\times12\times3\times4}{60\times15}=\frac{50400}{9}=5600 \text{ dollars.}$$

The perplexity produced by the endless variety of money denominations in different countries, has long been a subject of general regret. Like the equalization of weights and measures, it has at different times engaged the speculations of philosophers, and sometimes the attention of governments. The American plan of reckoning by tenths and hundredths of a dollar, is accounted a considerable step towards simplicity, and has been followed in some measure by the French government. At the beginning of the French revolution, the views of the enlightened men who belonged to the Assemblée Constituante, were directed to the formation of an universal standard for the regulation of weight and measure. The consequence has been the introduction of new denominations in both respects; but so slow are changes of this description, that the old method is still preferred throughout the chief part of France. In the adjoining countries, the new plan has not found, as far as we know, any imitators. Among ourselves, an equalization of weights and measures has been repeatedly talked of; but no investigation from authority has taken place since the year 1758, at which time a committee of the House of Commons was appointed, to make a report on the subject. Without venturing to go into the field of general disquisition, this committee put on record a very clear and accurate exhibition of the present state of our weights and measures; and ascertained, that the standard avoirdupois pound kept in the Mint weighed exactly 7000 grains troy, a weight strictly corresponding to that of the two other avoirdupois standards preserved for successive ages at the Exchequer and Guildhall. (χ)

EXCHEQUER, (*Scaccarium*, from the French *Echiquier*, or the German *Schatz-kammer*, Treasury), is a very ancient court of record, wherein the king's revenues are received, and all causes respecting the revenue and rights of the crown are heard and determined.

Camden says that this court took its name from the table at which they sat, the cloth which covered it being party-coloured, or *chequered.* (*Brit.* p. 113.) Some persons have thought that there was an exchequer under the Anglo-Saxon kings; but our best historians are of opinion, that we derived this institution from the ancient Norman exchequer, and that it was introduced from thence by William the Conqueror. It is certain that there was an exchequer in the time of his son Henry I. which was regulated and reduced to its present order by Edward I.

The exchequer consists of two parts or divisions: the *Receipt of the Exchequer*; and the *Court of Exchequer*. The former is occupied with the management of the royal revenue; the functions of the latter are judicial.

The principal officers of the Exchequer are the Lord Treasurer, the Chancellor, the Lord Chief Baron, and three other barons, with a *puisne* baron, who administers the oaths of all high sheriffs, under sheriffs, bailiffs, &c.; the Remembrancer for the King, who calls to account, in open court, all the great accountants of the crown, &c.; the Remembrancer for the Lord Treasurer, who makes out all estreats, and issues out writs and processes in many cases, &c.; two Chamberlains, who keep the keys of the treasury, where the records lie; a *Clerk of the Pipe*, into whose custody all accounts and debts due to the king are conveyed out of other offices, as water through a pipe; the Controller of the Pipe; the Clerk of the Estreats, the Foreign Opposer; the Auditors; four Tellers; the Clerk of the Pells, so called from his parchment rolls; the clerk of the *Nihils*; the clerk of the Pleas, &c.

The Court of Exchequer is inferior in rank to the courts of King's Bench and Common Pleas. It is divided into a court of equity and a court of common law. The court of equity is held in the exchequer chamber, before the Lord Treasurer, the Chancellor of the Exchequer, the Chief Baron, and three *puisne* Barons, whose original and primary business related to the fiscal rights of the crown. But now, all kinds of personal suits may be prosecuted in the Court of Exchequer, upon the surmise that the plaintiff is debtor to the king, which is held to be mere matter of form and words of course, the truth of which is never controverted. This fiction gives rise to the common law part of the jurisdiction of the Court of Exchequer, which is exercised by the Barons only. The writ, upon which all proceedings here are grounded, is called a *quo minus*, in which the plaintiff suggests that he is the king's debtor or farmer, and that the defendant hath done him the injury or damage complained of, *quo minus sufficiens existit*, by which he is the less able to pay the king his debt or rent. In the same manner, also, in the equity side of the court, any person may file a bill against another, upon a bare suggestion that he is the king's accomptant. In this court, on the equity side, the clergy have long been in use to exhibit their bills for non-payment of tithes; but the Chancery has now obtained a large share of this business. From the equity side of Exchequer, there lies an appeal directly to the House of Peers; but from the common law side, a writ of error must be first brought into the Court of Exchequer Chamber.

The *Court of Exchequer Chamber* has no original jurisdiction, but is only a court of appeal. It was first erected by statute 31 Edw. III. c. 12, to determine causes upon writs of error from the common law side of the Court of Exchequer. It consists of the Lord Treasurer, the Lord Chancellor, and the Justices of the King's Bench and Common Pleas. A second Court of Exchequer Chamber, in imitation of the former, was erected by statute 27 Eliz. c. 8, consisting of the Justices of the Common Pleas, and the Barons of the Exchequer, before whom writs of error may be brought to reverse judgments in certain suits, originally begun in the Court of King's Bench. Into the Court of Exchequer Chamber, (which then consists of all the judges of the three superior courts, and now and then the Lord Chancellor also,) are sometimes adjourned from the other courts, such causes as the judges, upon argument, find to be of great weight and difficulty, before any judgment is given upon them in the court below. From all the branches of this Court of Exchequer Chamber, a writ of error lies to the House of Peers.

The ancient Court of Exchequer in Scotland, which was the king's revenue court, was, by the treaty of union, (Art. 19.) to continue until a new revenue court should be established by parliament, which was accordingly done by 6 *Ann*. c. 26. The judges of this court are the High Treasurer of Great Britain, with a Chief Baron, and four other Barons, who must be made either of serjeants at law, or English barristers, or Scottish advocates of five years standing. All may plead before this court who can practice in the courts of Westminster, or in the Court of Session; and all the privileges of the College of Justice, are communicated to the barons, and to the other members of this court.

The jurisdiction of the Scottish Court of Exchequer extends to all matters regarding the revenues of the crown; but under two limitations, which were intended to preserve the private law of Scotland from innovation. 1st, That no debt due to the crown shall affect the debtor's real estate, in any other manner than such estate might be affected by the law of Scotland: and, 2dly, That the validity of the crown's titles to any honours, lands, or casualties, shall be tried, as formerly, by the Court of Session. See Madox, *Hist. of the Exchequer*; Blackstone's *Comment*, b. iii. ch. 4; Jacob's *Law Dict*. v. EXCHEQUER; and Erskine's *Inst. of the Law of Scotland*, b. i. tit. 3. § 30. *et seq*. (z)

EXCISE, (generally understood to be from the Belgic *accüse*, *toll* or *tribute*; though others, as Skinner, derive it from *assisa*, *assize*, as being rated by men appointed for that purpose,) a branch of the public revenue, arising from duties paid upon the manufacture or sale of certain commodities made or sold within the kingdom. Excise, in its proper acceptation, applies solely to duties imposed on consumable commodities made or produced at home, in contradistinction both to *customs*, which are duties payable upon commodities imported from abroad, and to *assessed taxes*, which are duties imposed upon the use of certain commodities not immediately consumable. From experience, however, of the utility of some of the excise regulations, certain branches of revenue arising from both of these have occasionally been put under the management of the excise, but this was an extension not contemplated at its first establishment.

The origin of excise, as well as other branches of revenue, must be sought for in the unavoidable wants of the state, consequent upon the progress of civilization and extension of commerce. The revenue required to defray the expence of providing either for the internal security or external defence of a state, may be drawn either from some fund belonging to the sovereign and the public, or from a part of the private revenue of the people themselves, levied by means of taxation. In the earlier periods of society, the former mode appears always to have prevailed, and, in many states, even after the introduction of commerce, public property has been regarded as one of the great sources of revenue; the silver mines of Attica constituted a large part of the public funds of the Athenian republic; and in all the kingdoms of modern Europe, the crown lands were long the chief resource on which the sovereign relied for defraying his expences. In time, this resource was found to be wholly insufficient, partly from the waste and dilapidation of this public property, but chiefly from the rapid increase of expenditure in the progress of society. To supply the deficiency, taxes were introduced, upon the equitable principle, that the people were bound to contribute a part of their private revenue, to answer the exigencies of the state, incurred for the common safety and benefit of all. Taxes must vary in their nature, according to the situation of the community, and the mode of subsistence. In countries chiefly agricultural, taxes upon land will probably form the principal source of the public income; in commercial states, taxes upon commodities will be found most availing. In taxing commodities, foreign goods imported are generally first selected; the duties payable upon these constitute that branch of revenue denominated *the customs*. As the exigencies of the state increase, taxation is extended to inland manufacture, and inland trade of various descriptions: it is this last branch of revenue which constitutes the *excise*.

It can hardly be doubted, that in every community so far advanced in civilization as to admit an active interchange of commodities and the separation of trades and professions, some species of taxation in the nature of an excise will be introduced, so soon as the wants of the sovereign or the state call for any extraordinary supply. That taxes upon inland consumable commodities actually took place in ancient times is evident, though the information we have of the manner in which the public revenues in those periods was levied, is too imperfect to enable us to determine with accuracy upon what commodities the duties were imposed, or under what regulations they were enforced. Among the Greeks and Romans, consumable commodities of most general use appear to have been subjected to various rates; and so far as can be found, these were laid on the sale or transit of the goods, and not, as in many cases in modern times, upon the manufacture. The common mode of levying the duties, was by officers stationed either at the principal ports, at the entrances of towns, or in certain places upon the usual roads; and the practice seems to have been universal, of farming out the different branches of revenue, instead of levying them by the immediate officers of government. In modern times, excise duties appear to have been first introduced by the commercial states. Among these, the extent of territory being inconsiderable, and the circulation of goods frequent and rapid, consumable commodities constituted an obvious, and probably an easier source of revenue than any other. These were therefore resorted to, when large sums for the public service were required. In the Low Countries, and in Holland, duties of this description were first brought to a regular system, and hence probably we have borrowed the name from the Belgic.

In England, though subsidies, aids, and benevolences, were from a remote period granted to the monarch, and though the customs, or duties upon imported goods, took place very early, yet it is generally understood, that what are properly termed excise duties, were never levied before the year 1643, when they were introduced by an ordinance of the republican parliament at Westminster. The duties then imposed, were at first chiefly confined to commodities, where it was thought the burthen would be least perceptible; such as beer and ale, cider, perry, and the like. The royalist parliament at Oxford quickly followed the example, by imposing similar duties. In 1644, the excise was extended by the Westminster parliament to butcher meat, wine, tobacco, sugar, and a number of other commodities in general use. The mode of levying the duties imposed by these acts, was more strict than it was afterwards found advisable to continue, not only makers and venders, but even private persons preparing the commodities for their own use being obliged to account. In 1656, by an ordinance of Cromwell, new excise duties were imposed in room of the former, on beer and ale, cider, perry, wine, oil, tin, and various other articles, which subsisted till the restoration. Upon the return of King Charles in 1669, Cromwell's ordinance of course fell to the ground; but some part of the excise duties which had been imposed were then re-established, and assigned to the crown as a compensation for the feudal tenures, and other oppressive branches of the prerogative. The commodities subjected to the tax at that time, were beer and ale, cider, perry, mead, vinegar, spirits, coffee, chocolate, sherbet, and tea; the tax attaching only to such as were made for sale, and coffee, chocolate, and tea, being rated by the gallon like strong waters.

These duties (with the exception of what had been rated upon the *gallon* of coffee, tea, and chocolate) were continued after the Revolution, and made part of the civil list revenue. The duties on spirits were carried to the aggregate fund in 1736; and those on malt liquors in England, were applied to the same fund in 1760. Large additions have from time to time been made to all of them. In 1694, a duty upon salt was established, which was properly an excise duty, though then put under different management. In 1697, malt was subjected to an excise duty, temporary at first, but revived in 1713, and, with large additions, continued to the present time. During the French wars in the reign of Queen Anne, the exigencies of the state calling for new impositions, the articles of sweets, soap, leather, candles, hops, paper, printed goods, starch, gold and silver wire, were all made liable to excise. In 1724, the duties upon tea, coffee, and chocolate, were transferred to the management of the excise. The manufacture of glass had been subjected to excise duty in the reign of King William, but such a tax being deemed prejudicial to an infant manufacture, it was very soon taken off; however, in 1746, excise duties upon glass were again imposed, which, with considerable additions, still subsist. The remaining branches of revenue now under the excise, are the following: Sales by auction, subjected to excise duty in 1777; bricks and tiles in 1784; wine in 1786; tobacco in 1789; salt in 1798; and stone bottles in 1812.

The introduction of the excise into Scotland, appears to have been nearly cotemporary with its establishment in England. Excise duties were first imposed in Scotland in 1644; these were farther regulated and extended in 1645 and 1647. After the Restoration, various duties termed excise, (though more properly customs) were imposed by parliament in 1661, upon wine, vinegar, soap, salt, tobacco, cloth, hats, gloves, and other goods imported; and along with these, a proper excise duty was imposed upon malt made within the kingdom. Brandy and mum imported, were subjected to excise in 1673. Malt liquors and spirits made in Scotland in 1693, the duty upon malt itself being soon after taken off. At the union in 1707, the excise duties then existing in England were extended to the whole united kingdom, the former Scotch excise duties being discontinued. Since that period, the excise duties have, in general, been the same in both parts of the kingdom, with some occasional deviations, for the most part in favour of Scotland. The extension of the excise on malt to Scotland in 1713, occasioned much discontent and commotion through the country for several years. At length, in 1725, the Scotch malt duty was fixed at one half of the English. Even with this abatement, the discontents were not allayed for some time, and it required no small degree of exertion and firmness to carry the tax into effect.

The excise duties in other countries, appear so far to resemble those in Great Britain, that the articles which form the subject of this tax are generally similar, allowing for unavoidable differences arising from the mode of living, the necessities of the state, and not unfrequently the ignorance of the rulers. In Holland, besides almost all the articles specified, as falling under the excise in Great Britain, similar duties are imposed on butcher meat, fuel, lead, hardware, &c. In France, the iron manufacture before the revolution was a subject of taxation; and an oppressive duty under the name of *gabelle*, levied on the consumption of salt. In Spain, cloth manufactured was taxed, and every time it was sold a new duty was incurred.

The general principles of the excise as a mode of taxation, have been already mentioned. It is a duty imposed on the manufacture or sale of commodities within the kingdom. For this purpose, all persons engaged in those branches of manufacture upon which the excise attaches, are required to make an entry of the premises in which the business is carried on; to allow access there to the revenue officers, that an account may be taken of the quantities manufactured; and a corresponding charge of duty made, according to the rates established by law. In several of the taxed articles, the interference of the excise is carried no farther, the subsequent sale and transit of the commodities being free; but in others, particularly where the duties are high, it has been found requisite, for the security of the revenue, to subject also the dealers and sellers of the commodity to the visits of the excise officers, in the places where the goods are kept and sold, and at the same time to prevent their transit, unless accompanied by a certificate, to signify that the duties have been paid. It is on account of these regulations chiefly, that certain imported goods, particularly spirits, wine, tea, and tobacco, have been put under the management of the excise. It has been found by experience, as Dr Smith justly remarks, that the excise regulations embarrass the operations of the smuggler more effectually than any other: hence, for the security of the revenue, they have been adopted in many articles, although it cannot be denied, that they may give rise to inconvenience and irritation, and are certainly in their nature not strictly agreeable to the free principles of the British constitution. Upon this account they have always been unpopular; and an instance occurred in the time of Sir Robert Walpole, when the prejudice of the nation was so strong against them, that that minister was forced to abandon a projected measure for subjecting wine and tobacco to the excise, although it was then believed, and has since been confirmed by experience, that the revenue would have received material advantage from it. The excise laws and regulations may, however, be vindicated, on the ground, that they are necessary when a large revenue is required for the service of the public; and though they are not free from inconvenience, yet in Great Britain at least, the subject is so guarded by law against any undue exercise of power in the officers, that few instances of real hardship occur. The complaints on that head, often arise from traders, who feel their illicit practices obstructed and prevented by their operation. There is, however, one specific regulation, not indeed peculiar to the excise, but still more common in the customs, which has been often, and with much justice, objected to, that of compelling the trader to return accounts upon oath, of the quantities of his goods subject to duty. The hazard of perjury, and the diminution, if not entire loss of all regard to the sanction of an oath, the inevitable consequence of this regulation, must be far greater evils than can be compensated by any additional security which the revenue can thus obtain. Independent of these objections, the regulations of the excise seem upon the whole to be well calculated for securing the revenue at the least possible expence. The tax generally attaches in that particular stage of the operation, where the difficulty of clandestine operation is considered to be greatest; the duty is found to be levied at less expence than the customs; and, after the tax is paid by the trader, it goes with as much rapidity as can well be attained into the public purse.

The mode of levying of the excise revenues at first was by farming them out,—a mode always odious to the public, frequently oppressive, and certainly of all others the most expensive in the end. That system, though pertinaciously adhered to in France, Spain, and many other countries, as being in fact best suited to an arbitrary government, has been wisely abandoned in Great Britain. The whole management of the excise in this country for more than a century past, has been put under the direction of officers appointed by, and immediately accountable to government. The superintendance is placed in two Boards; one for England, consisting of nine commissioners, of whom two are chairmen; and one for Scotland, consisting of five commissioners, of whom one is chairman. The commissioners are nominated by patent from the crown, and vested with the power of appointing all the inferior officers. The total number of officers employed in 1788, in levying and managing this branch of the revenue, is stated by Sir John Sinclair (*History of the Public Revenue*, cap. 4.) at 4477 in England, and 627 in Scotland,—a number which has since been increased, though not very greatly, considering the great increase of the sum collected. They now amount probably to about 6000 in all. The duties are charged by officers termed gaugers, over whom are placed supervisors. Payment is made to collectors in different places, no one being obliged to travel farther to make his payments than to the next market town. The collectors remit the money to the respective cashier for England or Scotland, and the nett amount is afterwards paid over to the receipt of exchequer.

Whatever objections the excise may be liable to in regard to some of its regulations, it is certain that ever since its establishment it has always been one of the most productive branches of the public revenue.

For the first ten or twelve years after the Restoration, when it was in farm, the amount received by the public was upon an average about £420,000 a year. For the whole period between the Restoration and the Revolution, the average may be reckoned about half a million a year. During the reign of King William; several new duties being imposed, and the country gradually advancing, the excise rose to somewhat above a million annually, the total revenues of England being then under four millions a year. At this period, it appears that the total excise in Scotland, which was then entirely separate from, and independent of, the English excise, amounted as paid into the exchequer to £ 40,000 a year. In the time of

Excommunication.

Queen Anne, new duties were added, and the union of the two kingdoms being effected, a junction, as well as assimulation of their revenues, took place. The annual average of the excise during that reign, was or England about £1,600,000; for Scotland nearly £61,000. Between 1715 and 1728, the reign of George . the produce of the excise for Great Britain, including he annual malt, was nearly £2,340,000 a year; for Scotland alone about £74,000. During the reign of George II. from 1728 to 1760, a gradual increase still ook place in the produce of the excise, the annual average being about £3,000,000 for Great Britain; the produce for Scotland somewhat above £97,000 per annum. n 1759, the year preceding the accession of his present Majesty, the nett excise as paid into the exchequer was £3,887,349; the gross produce for Scotland nearly £99,000. After the peace of 1763, the addition of everal new taxes, but still more the advancing state of ommerce and improvement, gave a new increase to the xcise; so that for the five years between 1771 and 776, the gross annual average amount for Great Britain was £5,340,000; and the gross annual average for Scotland nearly £140,000. During the last five years of the American war, there was still an increase, and proportionally greater in Scotland than in England, the verage of these five years being for Great Britain £5,642,327, and for Scotland alone nearly £247,000. At the time of the peace of Amiens in 1801, the gross mount for England was £12,507,807, and for Scotland £1,054,428. Since that period the amount has nearly doubled the gross produce in 1807; being for Great Britain about £24,000,000; for Scotland a little above £2,000,000. In 1813, the total for Great Britain was bout £24,700,000; for Scotland about £1,945,000. By the latest parliamentary finance statements, the gross produce for the year ending 5th January 1814, was for England £25,171,274 : 0 : 11½, and for Scotland £1,861,691 : 4 : 2. The expence of levying, collecting, and managing this large revenue, amounts to no more than £3, 19s. per cent. See Huic's *Abridgment of Excise Statutes. Scotch Acts.* Blackstone's *Commentary.* Smith's *Wealth of Nations.* Sir John Sinclair's *History of the Public Revenue.* Hamilton's *Enquiry into he Principles of Taxation. Parliamentary Reports and Papers.* (∂)

EXCITATION. See ELECTRICITY.

EXCOMMUNICATION, in ecclesiastical polity, is he judicial exclusion of offenders from the religious ites and other privileges of the particular community o which they belong. Founded in the natural right which every society possesses to guard its laws and privileges from violation and abuse, by the infliction of salutary discipline, proportioned to the nature of the offences committed against them, it has found a place n one form or another, under every system of religion, whether human or divine. That it has been made an engine for the gratification of private malice and revenge, and been perverted to purposes the most unjustifiable and even diabolical, the history of the world but too lamentably proves; yet this, though unquestionably a consideration which ought to inculcate the necessity of prudence as well as impartiality and temperance in the use of it, affords no valid argument against its legitimate exercise.

Under the dispensation of Judaism, the contraction of ceremonial impurity or uncleanness, was attended with an *ipso facto* excommunication from the more peculiar privileges of religion, which continued unrepealed, till the rites prescribed for restoration to legal purity were duly performed. Besides this, there does not appear to have been any excommunication of special divine appointment, except that which was immediately accompanied with the ultimate punishment of excision or death; and from which, of consequence, there was and could be no absolution. In the later ages of the Jewish church, indeed, this species of discipline was systematised by the Rabbins, whose opinions, however, are often so contradictory to each other, that it is next to impossible now to ascertain in what the different kinds of their authorised excommunications consisted. By many writers they have been divided into three classes, viz. *Niddui*, *Cherem*, and *Shammatha*, but Selden has satisfactorily shewn, that these three epithets are indiscriminately applied by the Rabbinic authors to every variety of this punishment, though in general the term *Cherem* denotes a severer species of it than the other two. Distinguished into greater and less, both of them might be pronounced on an individual either by a public judge, by a court, by a private person, or even by himself. The least kind, commonly termed, *Niddui*, i. e. *Separation*, might be incurred in a vast diversity of ways, of which no fewer than twenty-four are specified in the Talmuds and other Jewish writings; and of which several relate to moral and religious delinquencies, though others of them are of the most frivolous description. When pronounced by a court, it was preceded by private censure and admonition; after which, if the culprit gave no satisfactory evidence of repentance, *the house of judgment*, or the assembly of judges, solemnly warned and threatened him, that if he did not reform, he must fall under the sentence of public excommunication. If he still continued obstinate, his name, and the nature of his offence, were proclaimed in the synagogue to which he belonged, on four successive Sabbaths, in order to bring him to a just sense of his guilt; and if this also proved ineffectual, he was then solemnly excommunicated. The sentence, whether pronounced publicly or privately, was in force for thirty days, during which he was interdicted from approaching nearer any person, even his relations, than four cubits; from either doing or receiving any office of kindness which required greater proximity to other persons than that distance; and from performing the usual ablutions, previous to sitting down to his meals. On his remaining impenitent at the close of this period, it might be extended to thirty and even to sixty days longer; after which, if still incorrigible, he was subjected to the *greater* excommunication. This sentence was required to be pronounced by not fewer than ten persons, or at least in their presence, and with their concurrence: and it excluded those on whom it was inflicted from almost all the advantages of civil society. Of its horrible nature, some idea may be formed by the following extract from one which Buxtorf found in an ancient Hebrew MS.: "*Ex sententia Domini Dominorum sit in Anathemate Ploni filius Ploni in utraque domo judicii, Superorum scil. et Inferorum, in anathemate item Sanctorum excelsorum, in anathemate Seraphim et Ophannim, in anathemate denique totius Ecclesiæ maximorum et minimorum. Sint super ipsum plagæ magnæ et fideles, morbi magni et horribiles. Domus ejus sit habitaculum draconum; caliginosum fiat sidus ejus in nubibus; sit in indignationem iram et excandescendentiam; cadaver ejus objiciatur feris et serpentibus; lætentur super ipso hostes et adversarii; argentum et aurum ipsius dentur aliis; et omnes filii ejus* *ad ostium inimicorum ipsius sint expositi: super die ejus obstupescant posteri.—Absorbeatur sicut Korah et cœtus ejus; cum terrore et tremore egrediatur anima ejus; increpatio Domini occidat eum: stranguletur ut Achitophel in consilio suo; sicut lepra Gehazi sit lepra ipsius; neque ulla sit resurrectio ruinæ ejus; in sepultura Israelis non sit sepultura ejus; Alienis detur uxor ipsius, et super eam prostranto se alii in morte ejus. In hoc anathemate sit Ploni filius Ploni; et hæc sit hæreditas ipsius.*" Lexic. Talmud, p. 829. The pronouncing of such sentences was frequently accompanied with the lighting of tapers in the synagogue or court-room; the ringing of bells and sounding of trumpets, &c. practices to which the church of Rome have since had recourse, in order to give greater solemnity and terrific effect to their anathemas. Persons thus excommunicated were prohibited from carrying on their ordinary employments; could not buy or sell any thing but what was absolutely necessary for the preservation of life; and were not permitted to enter any place of instruction for the purpose of either teaching or being taught. No person was allowed to associate, or to eat or drink with them. They were incapacitated for acting either as judges or as witnesses; for circumcising their sons, and for assisting at the funeral obsequies, even of their nearest relations. The ordinary rites of burial were denied them; their friends were not suffered to mourn for them; and a large stone was left on their graves, or the people, and sometimes the judges, heaped stones on the spot where they were interred, as over Achan and Absalom.—The sentence of the *lesser* excommunication, when inflicted by a private person, might be removed by one public judge, or by three men chosen for the purpose; but to the absolution of those who excommunicated themselves, the sentence of ten persons was necessary. He who had been excommunicated in a dream, (as some imagined they might be) could be *loosened* from this sentence only by ten men learned in the law and the Talmud. Absolution from the *greater* excommunication, might be obtained from a single judge, provided he was a doctor of the law; but, in other cases, only from the concurring authority of three judges.—It is somewhat doubtful whether, in any instance, excommunication among the Jews, though pronounced by ecclesiastical judges, involved in it exclusion from the synagogues, or is justly to be regarded as having been more than a *civil* punishment, till about or after the Christian æra; but there can be no doubt whatever, that, subsequently to that period, it was so extended, and became in the strictest sense an ecclesiastical and spiritual malediction.

Without entering at all into the controversy concerning the *jus divinum* of excommunication under the Christian dispensation, we shall only observe, that the early fathers of the church appear to have justified it, chiefly on the ground of its necessity to the preservation of purity of conduct in their religious communities; and that during the two first centuries at least, it seems to have been exercised with becoming moderation. From Tertullian's apology, we learn, that the crimes which in his time subjected to exclusion from Christian privileges, were murder, idolatry, theft, fraud, lying, blasphemy, adultery, fornication, and the like; and, in Origen's treatise against Celsus, we are informed that such persons were expelled from the communion of the church, and lamented as lost and dead unto God, (*ut perditos Deoque mortuos*); but that on making profession, and giving evidence of penitence, they were received back as restored to life. It was at the same time specially ordained, that no such delinquent, however suitably qualified in other respects, could be afterwards admitted to any ecclesiastical office. Nor does it appear that the infliction of this discipline was accompanied with any of those forms of excommunication, of delivering over to Satan, or of solemn execration, which were usual among the Jews, and subsequently introduced into them by the Romish church. The authors and followers of heretical opinions which had been condemned by the judgment of the Episcopal order, were also subjected to this penalty: and it was sometimes inflicted on whole congregations when they were judged to have departed from the faith. In this latter case, however, the sentence seldom went farther than the interdiction of correspondence with these churches, or of spiritual communication between their respective pastors. To the same exclusion from religious privileges, those unhappy persons were doomed, who, whether from choice or from compulsion, had polluted themselves, after their baptism, by any act of idolatrous worship: and the penance enjoined on such persons, before they could be restored to communion, was often peculiarly severe. The consequences of excommunication, even then, were of a temporal as well as a spiritual nature. The person against whom it was pronounced, was denied all share in the oblations of his brethren; the ties both of religious and of private friendship were dissolved; he found himself an object of abhorrence to those whom he most esteemed, and by whom he had been most tenderly beloved; and, as far as expulsion from a society held in universal veneration, could imprint on his character a mark of disgrace, he was shunned or suspected by the generality of mankind.

It was not, however, till churchmen began to unite temporal with spiritual power, that any penal effects of a civil kind became consequent on their sentences of excommunication; and that this ghostly artillery was not less frequently employed for the purposes of lawless ambition and ecclesiastical domination, than for the just punishment of impenitent delinquents, and the general edification of the faithful. But as soon as this union took place, and in exact proportion to the degree in which the papal system rose to its predominance over the civil rights as well as the consciences of men, the list of offences which subjected their perpetrators to excommunication, was multiplied; and the severity of its inflictions, with their penal effects, increased in the same ratio. The slightest injury, or even insult, sustained by an ecclesiastic, was deemed a sufficient cause for the promulgation of an anathema. Whole families, and even provinces, were prohibited from engaging in any religious exercise, and cursed with the most tremendous denunciations of divine vengeance. Nor were kings and emperors secure against these thunders of the church; their subjects were, on many occasions, declared, by a papal bull, to be absolved from allegiance to them; and all who should dare to support them, menaced with a similar judgment. Nay, to such an extravagant length was this exercise of power carried, that instances are on record of bishops having issued formal excommunications against rats, mice, and even caterpillars, after a regular judicial process against them, in which they were allowed the benefit of an advocate and proctor, to plead and defend their cause. The pronouncing of sentence was accompanied with the lighting of torches, which were then thrown on the ground, and trampled under foot by the people, who beat time to solemn peals rung on the bells. Hence the old English expression, *to curse with bell, book, and candle.* The formula was then read to the congregation, and was of the following import: "M. et N. in nomine Patris et Filii, et Spiritus Sancti, et benedictæ nostræ Dominæ Sanctissimæ Mariæ, atque virtute angelorum, archangelorumque, &c. a sanctæ matris Ecclesiæ græmio segregamus, ac perpetuæ maledictionis anathemate condemnamus. Sintque maledicti in civitate, maledicti in agro, maledictum horeum eorum, et maledictæ reliquiæ eorum, maledictus fructus ventris eorum, et fructus terræ illorum. Maledicti sint ingredientes, et egredientes. Sintque in domo maledicti, in agro profugi; veniantque super eos omnes illæ maledictiones quas Dominus per Mosen in populum divinæ legis prævaricatorem se esse missurum intentavit; sintque Anathema Maranatha, id est, pereant in secundo adventu Domini. Nullus eis Christianus Ave dicat. Nullus Presbyter Missam cum eis celebrare præsumat, vel sanctum Communionem dare. Sepultura asini sepeliantur, et in sterquilinium sint super faciem terræ. Et sicut hæ lucernæ de manibus nostris projectæ hodie extinguuntur, sic eorum lucerna in æternum extinguatur, nisi forte resipuerint, et Ecclesiæ Dei quam læserunt, per emendationem et condignam pænitentiam satisfecerint."—An excommunicated person was proscribed as unworthy of the commonest enjoyments of social life; no one, not even his wife, children, or servants, was permitted to come near him, under pain of the lesser excommunication; he forfeited every natural right and legal privilege; and could not act in any public capacity, or succeed to any private inheritance. If he did not make satisfaction to the church, and procure absolution from the bishop within 40 days, he was laid hold of by the secular power, his property seized, his person imprisoned, and all his offices vacated; and if he died unabsolved, his body was not allowed to be buried, but ordered to be flung into a pit, or covered over with stones.

In the Greek church, the formulas of excommunication are not less dreadful than they anciently were in the church of Rome. The most frivolous offences, equally as the most heinous crimes, are visited with it; and the person who has been guilty of them is declared, if he do not repent, to be "separated from the Lord God Creator, to be accursed and unpardoned, and undissolvable after death." Then follow such imprecations as these: "Let wood, stone, and iron be dissolved, but not he: May he inherit the leprosy of Gehazi, and the despair of Judas: may the earth divide and swallow him up, like Dathan and Abiram: may he sigh and tremble on earth like Cain, and the wrath of God be on his head: may he reap no fruit of his labour, and beg his bread all the days of his life: may his works, his possessions, his labour, and his services, be accursed, always without effect or success, and blown away like dust: may he have the curses of the holy and righteous patriarchs, Abraham, Isaac, and Jacob, of the 318 saints who were the divine Fathers of the Synod of Nice, and of all other holy Synods: and, being without the church of Christ, let no man administer to him the things of the church, or bless him, or offer sacrifice for him, or give him the Αντίδωρον, or the blessed bread, or eat, or drink, or work, or converse with him; and, after death, let no man bury him, under penalty of the same condemnation." Such is the superstitious ignorance of the common people of this church, that they are said firmly to believe that the dead bodies of the excommunicated not only remain unconsumed, but are possessed with evil spirits; are fed and nourished during the night, and have been found 40 days after death, as ruddy in their complexion, and full of blood, as if they had been in perfect health. To prevent this, their relations are accustomed to cut their body in pieces, and boil them in wine.

In England, excommunication is incurred by contempt of the Bishop's Court, neglect of public worship, profane desertion of the sacraments, heresy, adultery, simony, &c. But if any spiritual judge pronounce this highest ecclesiastical censure for an offence of which he has not the legal cognizance, the injured party may prosecute him at common law, or he may be indicted for it by the public prosecutor. According to law, excommunication disqualifies a person for serving upon juries, for being a witness in any court, and even for bringing any action, either real or personal, for the recovery of a debt, or the inheritance of property. Nay, if the culprit does not, within 40 days after the sentence has been duly promulgated, submit and abide by the sentence of the spiritual court, on the bishop's certifying such contempt to the king in Chancery, a writ called *excommunicato capiendo*, or, from the bishop's certificate, *significavit*, may be issued, requiring the sheriff of the county to apprehend and imprison him, without bail or mainprize, till his reconciliation to the church is effected and certified by the bishop. This power, however, is now seldom exercised, and in general with becoming equity and moderation.

By the constitution of the Church of Scotland, the same crimes are punishable with excommunication as in England; but it is now seldom inflicted, except for contumacy. When the lesser excommunication (which involves only suspension from the sacraments) has failed of its desired effect, or, summarily, in the case of some particularly heinous offences, after the preparatory forms have been gone through, the officiating clergyman pronounces the sentence of higher or greater excommunication, in the following or similar words, to the person himself if present, or concerning him if absent: "Whereas thou N. hast been, by sufficient proof, convicted of ——, and after due admonition and prayer, remainest obstinate, without any evidence or sign of true repentance; therefore, in the name of the Lord Jesus Christ, and before this congregation, I pronounce and declare thee N. excommunicated, shut out from the communion of the faithful, debar thee from their privileges, and deliver thee unto Satan for the destruction of thy flesh, that thy spirit may be saved in the day of the Lord Jesus." The people are then warned to avoid all unnecessary intercourse with him; but at the same time the sentence does not dissolve the bonds of civil or natural relations. Anciently, the excommunicated were, by the law of Scotland, incapable of holding feudal rights; but now, no civil penalty or disqualification is attached to this *severissima disciplina, et ultimum fulmen Ecclesiæ.*

Among the ancient heathen also, excommunication was by no means infrequent; and consisted of two kinds, the less and the greater. Under the first, may not improperly be considered as included, such proclamations as that which Virgil mentions as having been addressed by the priest, at the celebration of the sacred rites of Proserpine:

> —— Procul, ô, procul este profani,
> Conclamat vates, totoque absistite luco.

In like manner, it was usual among the Greeks, on similar solemnities, for the officiating priest to say, *ἑκὰς*

Excommunication, Exeter.

ἑκας ἐστι βεβηλοι, or θυρας δ᾽ επιθεσθε βεβηλοις. But besides this, according to the religion both of Greece and Rome, the commission of particular crimes was punished, with the interdiction of fire and water to the culprit, and with exclusion from civil rights, as well as religious privileges. Adulteresses, and similar infamous persons, were prohibited from entering the public temples, or from being present at the performance of any sacred ceremony. But perhaps the most authentic, as it certainly is the most explicit document of the kind, is to be found in the Œdipus Tyrannus of Sophocles, where the Delphic Oracle is represented as sanctioning, if not dictating, the following excommunication of a parricide:

> Τον ἄνδρ᾽ ἀπαυδω τουτον ὅστις ἐστι γης
> Της δ᾽ ἧς ἐγω κρατη τε κ̀ θρονυς νεμω,
> Μητ᾽ ἐισδεχεσθαι μητε προσφωνειν τινα,
> Μητ᾽ ἐν Θεων ἐυχαισι μητε θυμασι,
> Κοινον ποιεισθαι, μητε χερνιβας νεμειν,
> Ὠθειν δ᾽ απ᾽ οικων παντας ὡς μιασματος
> Τυ δ᾽ ἡμιν ὄντος.

This greater excommunication was likewise accompanied with execrations and anathemas, called by the Greeks Αραι, and by the Romans *Diræ*, which consigned the offenders to the furies, and other dæmons of hell. We learn from Cæsar also, that the same spiritual weapon was employed with terrible effect by the ancient Druids: "Si quis," says he, "privatus aut publicus eorum decreto non stetit, sacrificiis interdicunt. Hæc pœna apud eos est gravissima. Quibus ita est interdictum, ii numero impiorum et sceleratorum habentur. Ab iis omnes decedunt, aditum eorum sermonemque defugiunt, ne quid ex contagione incommodi accipiant. Neque iis petentibus jus redditur, neque honos ullus communicatur." *De Bello Gal.* lib. vi. c. 13.

But of all the species of excommunications which have ever existed, that of *losing cast* among the Hindus is the most summary, the most easily incurred, and at the same time the most irremediable. The most trifling incident occasions it; such as eating or drinking, or even speaking with a person of another cast or nation. To partake of food with a European, or to use the food prepared for those of a different cast, is, in particular, the certain way of incurring this tremendous punishment. It is attended with the dissolution of every relation and connection in life; with disownment by every friend, and even by husband, or wife and children; the latter of whom, when the parent has lost cast, none will marry; and sometimes the whole family are involved in the same calamity and degradation with the head. These miserable Pariars, or Chandalas, for so they are termed, literally become outcasts and aliens. To touch, or even to converse with them, is to be polluted; and to shew them the least kindness, however distressing may be their circumstances, is inevitably to share the same dreadful fate. Nor when once lost can it ever be recovered. Instances indeed are known, in which persons have incurred it, merely by some one of their family being absolutely compelled to live under the roof of a Mussulman, and who have in vain offered a lack of rupees, or £10,000 sterling, to have it restored.

On the subject of this article, see Selden *de Synedriis, &c. Vet. Ebræor*, and *de Jure Gentium*; Böhmeri *Diss. Juris Eccl. Antiq.*; Rycaut's *State of the Greek Church*; Blackstone's *Commentaries*; Purdivan's *Collections*; and *Baptist Periodical Accounts*, vol. i. (*d*)

EXETER, VALE OF. See DEVONSHIRE. Vol. vii. p. 685. col. 2.

EXETER, the ISCA of Ptolemy, a city of England in Devonshire, in the hundred of Wonford. The town is delightfully situated on the slope of a rising ground, on the eastern bank of the river Exe, which winds round the south-west side of the city. It is surrounded with walls, which inclose a space four furlongs long, and three broad, nearly in the form of a parallelogram. This space is intersected by four principal streets, nearly at right angles, which have lately been well paved and flagged, and which meet at a point where a magnificent conduit called *Carfoix*, formerly stood, from the Norman words *quatre voix*, signifying four ways. The whole extent of ground occupied by buildings, is about $1\frac{3}{4}$ of a mile long, and one mile broad. All the gates have been taken down excepting the south-west gate. The remains of Rougemont castle, which derives its name from the red colour of the soil on which it stands, are situated on the north-east, and highest part of the city. It was erected by the West Saxons, and was very strong, both by nature and art. Its exterior wall, inclosing a pentagonal space, is now all that remains of it.

There are no fewer than 15 parish churches within the walls of the city, and four in the suburbs, besides several chapels, and a Jewish synagogue.

The cathedral is a large and magnificent building, dedicated to St Peter. It was begun in the reign of Athelstan, in 932, and though carried on under various bishops for 400 years, it was completed with the same uniformity as if it had been done by a single individual. The north tower, which contains a bell weighing 17,472, or 12,500 lbs. according to another statement, was finished in 1484. The cathedral was repaired and new paved in 1763; and a most beautiful modern painted glass window was put up over the west door in 1766. The cathedral consists of a nave, with two side aisles, two short transepts, formed out of two ponderous Norman towers, in 1286, and a chapter-house, in the form of a parallelogram, built in 1430; a choir, with side aisles, which was finished in 1318, and ten chapels, or oratories, with a room denominated the consistory court. On entering the cathedral from the west door, the nave has a striking and magnificent appearance. It is 76 feet wide within the walls, and 175 feet long, from the organ screen to the western door. The roof is sustained by 14 huge clustered columns, supporting 16 pointed arches, above which are two tiers of small open arches. The choir is of the same width as the nave, and is 128 feet long. St Mary's chapel is 51 feet long, and there is a space of 25 feet between it and the altar screen. The whole length of the cathedral, from east to west, is 408 feet, including the walls. The roof is 69 feet high, and the Norman towers 130 feet to the top of the battlements. These towers have the same shape and character; they have a massive and grand appearance, but are inferior, in point of architecture, to the ornamented parts of the cathedral. The windows of the cathedral are very large, and are adorned with tracery and painted glass. The east and west windows are particularly fine; the western one is 37 feet high by 27 broad. The lower part is divided into nine compartments, seven of which are occupied with full length figures of saints. In the north tower there is a curious clock, presented to the cathedral by Bishop Courtenay. The organ is very large, and is reckoned one of the finest instruments of the kind in England. The other principal buildings are the bishop's palace, session house, the new gaol, the barracks, the circus, the theatre, the guild-hall, the lunatic asylum, and the county hospital. The bishop's palace stands near the south-east side of the cathedral,

Exeter
‖
Exmouth.

nd is a venerable fabric built or enlarged by Bishop Courtenay. The session house was some time ago rected in the area inclosed by the walls on the north-west side; it is an elegant building of Portland stone, nd the assizes, quarter-sessions, and county-courts, re held in it. The new gaol for the county is situated n the north side of the city, below the castle hill. t is built of brick, from the designs of Blackburn, nd is elegant without and well arranged within. The barracks, which are erected near the gaol, are caable of accommodating 200 cavalry. The circus is uilt on the site of old Bedford house, on ground beonging to the Duke of Bedford; and near it is situated small theatre. The site of the birthplace of Henrietta, sister to Charles II. lies more to the south-east art of the city. The buildings erected upon it are very andsome, and are intended to form Henrietta Place. Her portrait, by Vandyck, is now in the Guild-Hall, and was presented to the city by Charles II. The Guild-Hall, which is commodious, was repaired in 1720. The luatic asylum is a large and elegant building, containng 48 apartments, and is furnished with hot, cold, hower, and vapour baths. The patients are classed ccording to their various degrees of insanity, and the ne extensive airing grounds, allotted for their use, re separated by lofty brick walls. The Devon and Exeter hospital for the sick and indigent poor, was ounded in 1740, by Dr Alured Clark, Dean of Exeer, aided by public subscriptions. It was opened on an. 1st, 1747. There is also, in Exeter, an infirmary or diseases of the eye. Besides various Sunday schools, here are eight regular schools for educating and clothng, and two institutions for maintaining poor childen. There are also various almshouses for the aged nd infirm; the principal of which is called Wynard's or God's House. Each person has a neat habitation, with small garden, and a weekly and an annual pension. n elegant stone bridge, which cost between £18,000 nd £20,000, is built over the Exe. It was begun in 770. On both sides of it are houses, with a church ver the greater part of it.

The trade of Exeter was formerly very extensive, om the navigable arm of the sea which flowed near s walls. Owing, however, to a ridiculous dispute etween the inhabitants and Hugh Courtenay, the Earl f Devon, that nobleman nearly ruined the navigation, y building weirs and dams in various parts of it, so as o prevent all vessels from passing or repassing. The de had hitherto flowed beyond the city, but it now nly reached Topsham, a town about 8½ miles nearer he sea. The navigation of the river was, however, stored with some difficulty, by a canal which was ut from Topsham to Exeter. The navigation was ill farther improved in 1695, when the present haen was constructed. By the erection of sluices and oodgates, vessels of 150 tons burden have been enaled to discharge their cargoes at a good quay made ear the walls of the city, where the custom-house is uilt. The total declivity from the quay at Exeter to he lowermost floodgate at Topsham, is 8 or 10 feet.

The woollen manufacture is the principal source of nployment for the labouring classes. Serges, drugets, duroys, kerseys, and everlastings, are brought in rough state from the vicinity of the town, and are yed and finished for exportation and home consumpon. Quantities of these goods, to the value of 500,000, are annually exported to Spain, Portugal, Germany, and Italy; and long-ells, to the amount of 400,000, are annually purchased by the East India Company. A large cotton manufactory, established on the banks of the Exe, formerly gave employment to about 300 persons, but it has now entirely failed. A very considerable and valuable wine trade is carried on in the town.

The Corporation, which has considerable revenues, consists of a mayor, 24 aldermen, a recorder, chamberlain, town-clerk, sheriff, four stewards, and several officers of inferior note. The corporate bodies within the city are 13, and each of them is governed by officers chosen annually. Markets are held here on Wednesday, Friday, and Saturday; and the fairs are on Ash-Wednesday, Whit-Monday, August 1st, and December 6th, for horses, cattle, sheep, and almost every commodity.

Exeter has the advantage of several very pleasant walks; the one on the north, encompassing the upper sides of the castle, and extending nearly from East Gate to North Gate, is a most delightful airy terrace, and is uniformly admired for its beauty. It was planted with elms in 1664. Above the quay, on the south side, is the fine terrace called the *Friers*. It rises above the river to the perpendicular height of 100 feet, and commands a most extensive and beautiful prospect. The air of Exeter is very salubrious, the average of burials being as 1 to 37 of the population.

The following is an abstract of the population-return for the city of Exeter, in 1811:

Number of inhabited houses . . .	2,879
Number of families that occupy them, .	4,465
Number of uninhabited houses, . . .	92
Number of families chiefly employed in agriculture,	156
Do. employed in trade, manufactures, &c.	2,898
Males, ...	7,908
Females, ...	10,988
Total population in 1811, . . .	18,896
Increase since 1801,	1,508

West Long. 3° 30′ 34″, North Lat. 50° 44′. See Polywhele's *History of Devonshire*; Jenkin's *History and Antiquities of Exeter*, 1806; the *Beauties of England and Wales*, vol. iv. p. 46—88; but particularly Sir Henry Englefield and Dean Lyttelton's *Historical Account of Exeter Cathedral*, with several prints from drawings of Mr J. Carter, published by the Society of Antiquaries. An engraving of the north tower of Exeter cathedral, and of the south gate of the town, are given in the *Beauties of England and Wales*, vol. iv. (*w*)

EXFOLIATION. See SURGERY.

EXHALATION. See EVAPORATION and METEOROLOGY.

EXMOUTH, is the name of a celebrated watering place in Devonshire, situated on the north side of the mouth of the river Exe. About a century ago, it was only a small hamlet inhabited by fishermen, but it was brought into notice by one of the judges of the circuit, who received great benefit from it as a bathing place. Exmouth is situated near the sea, between the cliffs, which as it were open to receive it. It is sheltered on the north-east and south-east by some high hills, which rise behind the town, and supply it with excellent water. The town is furnished with every accommodation as a watering-place, and has a good assembly-room. The houses are in general low and inconvenient, though well built, but some of them are good and elegant. The walks are delightful, and command extensive and picturesque views. The prospect from Chapel Hill embraces a line of coast extending for 20 miles from Exeter to the Berryhead. Several hills which gradually ascend from the coast, on the opposite side of the river, break this line; and behind these hills arise several bold towering headlands, of various shapes and unequal heights.

Exmouth has a chapel of ease, and is a chapelry of the parish of Littleham. According to the population returns for 1811, the parish of Littleham and the town of Exmouth contained 459 inhabited houses, 473 families, 51 families employed in agriculture, 371 in trade and manufactures, 968 males, 1333 females, and a total population of 4301. See Polywhele's *History of Devonshire*, vol. ii. p. 215. (*w*)

EXOTERIC, is a term applied to the public doctrine of the ancient philosophers which was openly taught to the world, the exoteric or acroamatic doctrines being confined to a small number of select disciples. (*w*)

EXPANSION, from the Latin *expando*, 'I expand,' is a term employed in physics, to denote that increase of magnitude which almost all bodies, whether solid, fluid, or aëriform, receive from an increase of temperature. The instruments by which the expansions of solid bodies are measured, are named Pyrometers, which were originally constructed by means of multiplying wheels, screws, and levers; but they have recently been constructed with micrometer microscopes, which enable us to measure the expansion of solids with singular accuracy. By means of a pyrometer, Mr Ellicott obtained the following expansions for seven metallic bodies, by the same elevation of temperature.

Ellicott's experiments.

Gold.	Silver.	Brass.	Copper.	Iron.	Steel.	Lead.
73	103	95	89	60	56	149

Ferguson's.

Mr James Ferguson obtained the following measures:

Brass.	Copper.	Iron.	Steel.	Lead.	Tin.
5	$4\frac{1}{2}$	3	3	7	6

Berthoud's.

M. Berthoud obtained the following results with rods three feet two inches and five lines long, five lines wide, and three lines thick, which were placed in a situation where the thermometer rose from 0° to 27° (of Reaumur, probably). The measures are given in parts of a line.

Brass.	Copper.	Iron.	Steel tempered and blued.
$\frac{121}{360}$	$\frac{107}{360}$	$\frac{78}{360}$	$\frac{77}{360}$

Experiments of a similar kind were made by Smeaton, Ramsden, Muschenbroek, Borda, General Roy, and Mr Troughton.

Troughton's experiments.

In 1794, Mr Troughton made a pyrometer for Captain Mendoza, similar to that made by Ramsden, and described by General Roy in the Philosophical Transactions for 1785, and the instrument having remained some months in his possession, he embraced the opportunity of examining the expansions of brass, steel, cast iron, and flint-glass. The following were the results which he obtained:

Brass .000640. } Expansion on one inch with 60° of the mercurial thermometer.
Steel .0003966. Ditto ditto.

The results for cast iron and flint glass he has unfortunately lost. Although these measures were obtained after frequent repetitions of the experiments, made with the greatest care, yet they differed considerably from those obtained by General Roy.

In 1794, Mr Troughton constructed a pyrometer * on a new principle; but as it was only designed for trying pendulums in a finished state, a length greater than 40 inches could not be subjected to trial. With this instrument he obtained the following results:

Silver . . . .000694. } Expansion on one inch with 60° of the merc. therm.
Iron wire . Hard drawn } .000480. do. do.
Platina . . .0003305. † do. do.

Mr Troughton considers all the experiments which have hitherto been made on the expansion of solids, as undeserving of confidence, and he proposes to construct a new pyrometer of the kind already mentioned, so as to be able to receive a *ten* feet rod. A series of experiments made with such an instrument, and by a philosopher of Mr Troughton's known accuracy, will be a most acceptable present to the physical sciences, and will probably lead to a determination of the law which regulates the expansion of solid bodies.

The results of the best experiments we have given in the following valuable Table; for which, with the exception of a few additions, we are indebted to Dr Thomas Young. It exhibits the increase both of length and bulk for 180°, and for 1° of Fahrenheit's scale.

Table shewing the Expansions of Solid Bodies, according to the Experiments of various Philosophers.

Solid Bodies.	For 180° F. In length.	 In bulk.	For 1° F. In length.	 In bulk.	Remarks.
Earthenware, ...	- -	- -	- -	- -	Wedgwood says, that earthen ware made porous by charcoal, expanded only $\frac{1}{3}$ as much as when solid.
Wood, ...	- -	- -	- -	- -	Much less than glass. Rittenhouse.
Glass tube, ...	.00077615	.002330	.00000431	.00001294	Roy. Phil. Trans. 1783. He had before found a glass tube expand four times as much as a rod.
— — — —	.00083333	.002502	.00000463	.00001390	Smeaton. Phil. Trans. 1754.
			.0000046	- -	Deluc's mean. Phil. Trans. 1778.
Glass rod, ...	.00080787	.002426	.00000449	.00001347	Roy. The same glass as the tube.
Deal, ...	- -	- -	- -	- -	Roy, 1777. As glass.

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* Mr TROUGHTON has been so kind as to promise the Editor a description of this ingenious instrument for the article PYROMETER.

† These results are now published for the first time.

Expansion.

Solid Bodies.	For 180° F. In length.	For 180° F. In bulk.	For 1° F. In length.	For 1° F. In bulk.	Remarks.
Platina,	000856	.002570	.00000476	.00001428	Borda.
Platina,	.0009	.0027	.0000050	.000015	Wollaston.
Platina,			.00000551	.0000165	Troughton.
Palladium,	.0010	.0030	.0000056	.000017	Wollaston.
Platina and glass,	.0011	.0033	.0000061	.0000183	Berthoud.
Regulus of antimony,	.001083	.003253	.00000602	.00001805	Smeaton.
Cast iron prism,	.0011094	.003332	.00000617	.0000185	Roy.
Cast iron,	.0011111	.003337	.00000618	.00001853	Lavoisier.
Steel rod,	.0011447	.003438	.00000636	.00001907	Roy.
Blistered steel,	.001125	.003379	.00000625	.00001875	Phil. Trans. 1795, 428.
— — — —	.001150	.003454	.00000639	.00001917	Smeaton.
Steel,	.0011574	.003476	.00000642	.00001928	Lavoisier.
— — — —			.00000661	.00001985	Troughton. Nich. IX. p. 230.
Hard steel,	.001225	.003679	.00000681	.00002042	Smeaton.
Annealed steel,	.00122	.00367	.0000068	.0000204	Muschenbroek.
Tempered steel,	.00137	.00411	.0000076	.0000228	Muschenbroek.
Iron,	.001156	.003472	.00000642	.00001926	Borda.
— — — —	.001258	.003779	.00000699	.00002097	Smeaton.
Iron wire hard drawn			.0000080	.000024	Troughton.
Annealed iron,	.00133	.00400	.0000074	.0000222	Muschenbroek.
Hammered iron,	.00139	.00417	.0000077	.0000231	Muschenbroek.
Bismuth,	.001392	.004180	.00000773	.00002320	Smeaton.
Annealed gold,	.00146	.00438	.0000081	.0000243	Muschenbroek.
Gold,	.0015	.0045	.0000093	.000025	Ellicott, by comparison.
Gold wire,	.00167	.00502	.0000093	.0000279	Muschenbroek.
Copper hammered,	.001700	.005109	.00000944	.00002833	Smeaton.
Copper,	.00191	.00573	.0000106	.0000318	Muschenbroek.
Brass,	.001783	.005359	.00000991	.00002973	Borda.
Brass scale, supposed from Hamburg,	.0018554	.005576	.00001031	.00003092	Roy.
Cast brass,	.001875	.005635	.00001042	.00003125	Smeaton.
English plate brass rod,	.0018928	.005689	.00001052	.00003156	Roy.
English plate brass trough,	.0018949	.005695	.00001053	.00003159	Roy.
Brass,	- -	- -	.00001066	.00003200	Troughton. Nich. IX. p. 230.
Brass wire,	.001933	.005811	.00001074	.0000322	Smeaton.
Brass,	.00216	.00648	.0000120	.0000359	Muschenbroek.
Copper 8, tin 1,	.001817	.005461	.00001009	.00003028	Smeaton.
Silver,	.00189	.005681	.00001050	.0000315	Herbert.
— — — —	.0021	.0063	.00001167	.000035	Ellicott, by comparison.
— — — —	.00212	.00636	.0000118	.0000354	Muschenbroek.
— — — —			.00001157	.000034	Troughton.
Brass 16, tin 1,	.001908	.005736	.00001056	.00003168	Smeaton.
Speculum metal,	.001933	.005811	.00001074	.00003222	Smeaton.
Spelter solder, brass 2, zinc 1,	.002058	.006187	.00001146	.00003430	Smeaton.
Fine pewter,	.002283	.006866	.00001238	.00003714	Smeaton.
Grain tin,	.002483	.007469	.00001379	.00004137	Smeaton.
Tin,	.00284	.00852	0000158	.0000474	Muschenbroek.
Soft solder, lead 2, tin 1,	.002508	.007545	.00001393	.00004179	Smeaton.
Zinc 8, tin 1, a little hammered,	.002692	.008095	.00001496	.00004388	Smeaton.
Lead,	.002867	.008625	.00001592	.00004776	Smeaton.
— — — —	.00344	.01032	.0000191	.0000573	Muschenbroek.
Zinc,	.002942	.008850	.00001634	.00004902	Smeaton.
Zinc, hammered out half an an inch per foot,	.003011	.009061	.00001673	.00005019	Smeaton.

It has been found, in general, that equal increments of heat produce a greater expansion at a high temperature, than they do at a low one.

The expansion of metallic bodies seems to have some connection with their fusibilities. Platina, the least fusible of the metals, has the lowest expansion; and lead, one of the most fusible, has the greatest expansibility. The most fusible glass is also found to be the most expansible.

Experiments on the contraction of glass.

From a number of experiments made with Prince Rupert's drops, which are formed by dropping melted glass into cold water, Dr Brewster has endeavoured to obtain a measure of the expansion of glass when in a fluid state. When the drops are made of flint glass, they contain a number of cavities formed by the contraction of the glass in cooling. These cavities contain no air. They increase with the magnitude of the drops, and may therefore be considered as a measure of

Experiments on the contraction of glass.

the contraction which the glass undergoes in its transition from the temperature at which it melts, to the ordinary temperature of the atmosphere. The magnitude of this contraction is measured by the difference between the specific gravity of the annealed and the unannealed glass. This measure of the contraction must always err in defect, but the maximum result obtained from a considerable number of drops, may be regarded as a tolerably correct measure of the diminution of density. Those drops should be employed in which the cavities are most numerous, and scattered over every part of their length. In some large drops of flint glass, the number of cavities is given. Dr Brewster found that the specific gravity of unannealed flint glass was 3.20405, and that of annealed flint glass, from the same pot, 3.2763. Hence the expansion in passing from the fluid to the solid state, is greater than $\frac{1}{45.3}$, or 0.002205. See the *Phil. Trans.* for 1815, p. 1. where a full account of these experiments is published.

Cast iron, antimony, and bismuth, form exceptions to the general law of expansion, as they actually increase in bulk in passing from the solid to the fluid state. Mr Mushet has established this fact for cast iron, by numerous experiments, which prove that it is most dense when fluid, and that it acquires its greatest volume in passing from the fluid to the solid state. The contraction of argillaceous bodies, by an increase of temperature, will be described in our account of Wedgwood's THERMOMETER.

On the Expansion of Liquids.

On the expansion of liquids.

We have already remarked that all fluid bodies are also expanded by an increase of temperature. The common method of measuring these expansions is to enclose them in a glass tube, and to observe the different heights to which they rise when subjected to different temperatures. These heights diminished by the expansion of the glass tube, will afford an accurate measure of the expansion of the included fluids. In this way M. De Luc made a number of experiments, which we have given in the following Table, the degrees in the first column being those of Reaumur's thermometer.

Table of the Expansion of different Fluids.

Mercury.	Diff.	Oil of olives.	Diff.	Essential oil of chamomile.	Diff.	Essential oil of thyme.	Diff.	Strong spirit of wine.	Diff	Water saturated with sea-salt.	Diff.	Common water.	Diff.
80°		80°.0		80°.0		80°.0		80°.0		80°.0		80°.0	
	5		5.4		5.3		5.7		6.2		5.9		9.0
75		74.6		74.7		74.3		73.8		74.1		71.0	
	5		5.2		5.2		5.5		6.0		5.7		9.0
70		69.4		69.5		68.8		67.8		68.4		62.0	
	5		5.0		5.2		5.3		5.9		5.8		8.5
65		64.4		64.3		63.5		61.9		62.6		53.5	
	5		5.1		5.2		5.2		5.7		5.5		7.7
60		59.3		59.1		58.3		56.2		57.1		45.8	
	5		5.1		5.2		5.0		5.5		5.4		7.3
55		54.2		53.9		53.3		50.7		51.7		38.5	
	5		5.0		5.1		5.0		5.4		5.1		6.5
50		49.2		48.8		48.3		45.3		46.6		32.0	
	5		5.2		5.2		4.9		5.1		5.4		5.9
45		44.0		43.6		43.4		40.2		41.2		26.1	
	5		4.8		5.0		5.0		5.1		4.9		5.6
40		39.2		38.6		38.4		35.1		36.3		20.5	
	5		5.0		5.0		4.9		4.8		5 0		4.6
35		34.2		33.6		33.5		30.3		31.3		15.9	
	5		4.9		4.9		4.9		4.7		4.8		4.7
30		29.3		28.7		28.6		25.6		26.5		11.2	
	5		5.0		4.9		4.8		4.6		4.6		3.9
25		24.3		23.8		23.8		21.0		21.9		7.3	
	5		5.0		4.9		4.8		4.5		4.6		3.2
20		19.3		18.9		19.0		16.5		17.3		4.1	
	5		4.9		4.8		4.8		4.3		4.5		2.5
15		14.4		14.1		14.2		12.2		12.8		1.6	
	5		4.9		4.8		4.8		4.3		4.4		1.4
10		9.5		9.3		9.4		7.9		8.4		0.2	
	5		4.8		4.7		4.7		4.0		4.2		0.6
5		4.7		4.6		4.7		3.9		4.2		0.4	
	5		4.7		4.6		4.7		3.9		4.2		0.4

By examining the results in the preceding Table, it will appear that the expansibilities increase rapidly near the boiling point, and that near the freezing point there are considerable irregularities. If we divide the scale of the thermometer between the freezing and the boiling point, and between 0° and 80° of Reaumur, or 32° and 212° of Fahrenheit into two equal parts, viz. from 0° to 40°, and from 40° to 80° of Reaumur, or from 32° to 122°, and 122° to 212° of Fahrenheit, Deluc found that fluids expand more in the higher division than in the lower, and he obtained the following results:

Fluids.	Ratio of expansion in the higher division to that in the lower.		
Quicksilver, ...	15	to	14.0
Olive oil, ...	15		13.4
Linseed oil, ...	15		13.4
Chamomile oil, ...	15		13.0
Water saturated with salt, .	15		11.6
Alcohol, ...	15		10.9
Water, ...	15		4.7

Anomaly in the expansion of water.

The results for water contained in the last column of the Table, exhibit a very remarkable deviation from the general law observed by all the other fluids in the Table, as it possesses the remarkable and anomalous property of having its maximum density at 40°, and consequently of contracting when its temperature is either diminished or increased. This property of water, first observed by the Florentine Academicians in 1667, seems to have been first accurately examined by Dr Croune towards the end of the 17th century. Dr Hook ascribes the phenomenon to the contraction of the vessel; but it has been shewn, in the most satisfactory manner, by the experiments of Mairan, De Luc, Dr Hope, Mr Dalton, and Sir Charles Blagden, that the phenomenon is not the result of any illusion. Sir Charles Blagden has proved that if water be kept free of all agitation so as to prevent it from being frozen at 32°, and is cooled down to 21° or 22°, the expansion still continues under an increasing ratio. Mr Dalton fixed the maximum density of water at 42½° of Fahrenheit; he found that the expansion was scarcely perceptible from 41° to 44°, and that from 41° to 32° the expansion was about $\frac{1}{150}$th part of the whole expansion from 42½° to 212°. He confirmed Deluc's observation, that the expansion for any number of degrees, either above or below 42½° was the same; but he afterwards thought that it was greatest below 42°. He also verified the observation of Sir Charles Blagden, that the expansion continues below 32°, and he succeeded in cooling it so far down in a tube, that the water had expanded and risen to the same height as if it had been heated to 75°. Hence, it must have been cooled down to 10°. As soon as it was frozen, it sprung up to 128°.

These remarkable appearances were regarded by several philosophers as so anomalous, that they were probably occasioned by some hidden source of error in the experiments; and even Mr Dalton himself was induced to believe, that the anomaly exhibited by water was only apparent, and arose from the contraction of the vessel in which the experiment was made. In order to investigate this point, he repeated the experiments in earthen ware and metallic vessels, and compared the results with those made in glass. In all these trials, the point of maximum density, instead of being the same, varied with each substance, as will appear from the following Table:

		Water lowest.	Water the same height.
Brown earthen ware, No. 1.	at 36°	at 32°	and 40°
Brown earthen ware, No. 2.	38	34	44
Queen's ware, ...	40	32	48
Flint glass	41½	32	51
Iron, thin plate	42½	32	53
Copper	45½	32	59
Brass	46	32	60
Pewter	46	32	60
Lead	49½	32	67

Notwithstanding the accurate experiments of M. Lefevre Gineau, who proved the maximum density of water to be 39°.2, the results obtained by Mr Dalton threw a considerable degree of uncertainty over the subject, and chemists were divided in their opinions, till the subject was investigated by Dr Hope in a new manner, which was not liable to any error arising from the contraction of the containing vessels. It occurred to this learned chemist, that if water expanded by a diminution of its temperature below 40°, the expansion might be rendered visible by the change of place, which would happen in a column of water when cooling from 40° to 32°, or when heating from 32° to 40°, as the water, which had a temperature of 32°, would necessarily rise in both cases towards the surface. He therefore filled a glass jar, 8½ inches deep and 4½ broad, with water at the temperature of 32°, and suspended in it two thermometers, one having its bulb about half an inch from the bottom, and the other about half an inch from the surface. The vessel being placed in a room having the temperature of 60°, it was found that as the temperature rose to 38°, the thermometer at the surface was always one degree lower than the one at the bottom; a sufficient proof that the density of the water increased as its temperature rose above 32°. In order to obtain a still more striking result, Dr Hope employed a jar 21 inches high, and four in diameter, and he adjusted at the middle of its height a bason of tinned iron, by filling which, either with hot water, or a frigorific mixture, he could apply heat or cold to the middle portion of the fluid column. A thermometer being fixed at the top and bottom of the jar as before, the jar was filled with water at 32°, and water of the temperature of 68° was poured into the bason of tinned iron. The lower thermometer rose from 32° to nearly 37° before the upper thermometer indicated the smallest increase of temperature, the warm current having moved downwards in consequence of the contraction or increase of density of the water. Dr Hope reversed this experiment by filling the bason with a frigorific mixture, while the water in the jar had a temperature of 39½°. The upper thermometer descended to 33° in the course of two hours, while the lower one suffered almost no change, the current of cooled water ascending to the top of the jar. By thus varying his experiments in a very beautiful and skilful manner, Dr Hope decided the question of the maximum density of water, and is entitled to the honour of having been the first who really established the existence of this singular anomaly.

Experiments of Dr Hope.

Experiments of M. Arago.

When the writer of this article had the pleasure of seeing Monsieur Arago at Paris in the course of last summer, he mentioned to him a series of experiments made on the refractive power of water at different temperatures, in order to determine if its maximum density was above 32°. He filled a prism with water at the temperature of 32°, and observed the angle of deviation produced by refraction, while its temperature rose from 32° to 212°. The angle of deviation was greater at 32°, and it gradually diminished to 212°, exhibiting no marks whatever of a variation of refractive power at 40°, or at any point between 32° and 212°. Hence Monsieur Arago concluded, that since the refractive power always increases with the density, the density of water must be at a maximum at 32°. This conclusion might have been admitted to have considerable weight, before Dr Hope had established the opposite conclusion by direct experiment; but, independent of this circumstance, we have no hesitation in saying, that M. Arago's conclusion is not legitimately deducible from his experiments. It is assumed in his reasoning, that *the refractive power of bodies increases with their density*, a doctrine which requires to be established by direct experiment, before it can be admitted as a valid argument in favour of any other position. Nay, it has actually been proved by Albert Euler from numerous experiments, that the refractive power of glass is increased by heat. An augmentation of temperature of 60° of Reaumur diminished the focal length $\frac{1}{95}$th part, and an augmentation of 83° produced a diminution of $\frac{1}{97}$. M. Euler concludes, without sufficient evidence, that the refractive power of all fluids is increased with heat; but though this is obviously erroneous, yet the experiments which he has made completely overturn the assumption of M. Arago, that the density at different temperatures may be inferred from the refractive power, and leave the subject of the maximum density of water in the same state as it had been left by Dr Hope.

Experiments by the writer of this article.

No experiments, so far as we know, have been made, with the view of explaining this singular property of water, nor does it readily appear how such experiments could be made. We have often thought that an incipient crystallization takes place at the point of maximum density, and gradually increases till the congelation is completed. But in what manner are we to render this incipient crystallization apparent? It is not visible to the eye; nor can it be detected by the application of any known instrument. It has often occurred to us, that it may be rendered visible, if it does exist, by the action of the water in depolarising a ray of polarised light, a property which is possessed by the water as soon as it is converted into ice. We have shewn from numerous experiments, that a piece of glass which has no depolarising structure, receives it by an augmentation of temperature, and again loses it when the temperature diminishes, and this communication and destruction of the depolarising virtue takes place when the glass is perfectly solid. Hence it is reasonable to infer, that water, though still in a fluid state in passing from 40° to 32°, may be gradually receiving that peculiar arrangement which is necessary to depolarise light, and which belongs to crystallized bodies. Several months ago, we tried this experiment in a very rude manner, by melting a quantity of snow between two plates of glass, and, after the snow was completely melted, a considerable quantity of light was depolarised. As this effect, however, might have been produced by some invisible portions of unmelted snow, we do not consider the experiment as worthy of any confidence. We have, however, began a series of experiments, for the purpose of determining this interesting point.

Expansion. Experiments by the writer of this article.

We shall now conclude this branch of the subject, with a tabular view of the different experiments that have been made on the expansion of mercury, water, the acids, and alcohol, which have been collected and arranged in a tabular form by Dr Thomas Young.

Table shewing the Expansion of Mercury, according to different Authors.

	For 180° of Fahsenheit. Expansion in Bulk.	For 1° of Fahsenheit.	
Mercury, ...	.015885	.0000855	Cotte, probably in glass.
———	.0165	.0000917	Lichtenberg, mean of several experiments.
——— Specific gravity, 13.6 at 45°	.01655	.000092	Achard in glass.
	.0185	.000103	De Luc and La Place.
——— from 32° to 104°		.00010415	De Luc, corrected by Gen. Roy.
———		.000108	Roy.
——— Specific gravity 13.61 at 68°		.000104	Lord Charles Cavendish, mean of Shuckburgh's experiments.
———		.00010985	Rosenthal.
———	.017583	.000097	Hällstrom.

Table shewing the Expansion of Water.

	Specific gravity.	Diminution of Sp. Gr.		Expansion.		
	Observed.	Observed.	Calculated.	Observed.	Calculated.	For 1°.
10°	As 69° Dalton corrected					
30	.99980 Gilpin, 1794.	20	18	.00020	.00018	.00004
32	.99988 G.	12	11	.00012 (.000144 M. Inst.)	.00011	.0003
34	.99994 G.	6	5	.00006	.00005	.00002
39	1.00000 G.	0	0	.00000	.00000	.00000
44	.99994 G.	6	5	.00006	.00005	.00002
48	.99982 G.	18	18	.00018	.00018	.00004
49	.99978 G.	22	22	.00022	.00022	.00004
54	.99951 G.	49	48	.00049	.00048	.00006
59	.99914 G.	86	84	.00086	.00084	.00008
64	.99867 G.	133	130	.00133	.00130	.00010
69	.99812 G.	188	186	.00188	.00186	.10012
74	.99749 G.	251	250	.00251	.00251	.00014
77		225 De Luc, by comparison.		.00299 Achard.		

Expansion.

	Specific gravity. Observed.	Diminution of Sp. Gr. Observed.	Diminution of Sp. Gr. Calculated.	Expansion. Observed.	Expansion. Calculated.	For 1°.
79	.99680 G.	320	322	.00321	.00326	.00016
(82)	.99612 Kirwan.	388	368	.00389	.00372	.00017
90	.99511 G. 1790.	489	509	.00491	.00513	.00020
100	.99313 G.	687	711	.00692	.00720	.00024
102	.99246 K.	754	753	.00760	.00763	.00025
122	.98757 K.	1243	1247	.01258	.01264	.00029
		1128 De Luc.		.00949 Achard.		
142	.98199 K.	1801	1818	.01833	.01859	.00031
162	.97583 K.	2417	2448	.02481	.02512	.00034
167		2520 De Luc.				
182	.96900 K.	3100	3109	.03198	.03219	.00036
202	.96145 K.	3855	3802	.04005	.03961	.00037
212	.95848 K.	4152	4140	.04333	.04332	.00038
		4400 De Luc, by comparison.				

The formula from which Dr Young has calculated the expansion in the preceding Table, is

$$.0000022f^2 - .00000000485f^3,$$

or more shortly $22f^2(1 - .002f)$ in ten millionth parts, f being the degrees of Fahrenheit's thermometer, either way from 39°. The diminution of specific gravity is expressed by

$$.0000022f^2 - .00000000472f^3.$$

Table shewing the Expansions of Acids, &c.

	For 1° of Fahrenheit.
Sulphuric acid,	.00031 Achard.
Sulphuric acid, sp. gr. 1.7,	.00026 At 60° Kirwan. Irish Transactions.
Sulphuric acid, sp. gr. 1.84,	.00021 At 55° Kirwan.
————	.00029 At 60° Kirwan.
————	.00037 At 65° Kirwan.
Muriatic acid, sp. gr. 1.185,	.00035 At 50° Kirwan.
Nitrous acid, sp. gr. 1.48,	.00037 At 43° Kirwan.
————	.00055 At 60° Kirwan.
————	.00070 At 65° Kirwan.
Spirit of turpentine,	.00052 Achard.
Vitriolic ether,	.00072 Achard.
Linseed oil	.0009 about 32° Achard.
Olive oil	.0007 about 100° Achard.

Table shewing the Expansion of Alcohol.

	Comparative Specific Gravity.	By Observation.	By Formula.	Expansion supposing the Unit at 32°.		For each Degree.
Spirit highly rectified, specific gr. at 60°. 825.	0° Fahrenheit.		1.0326	0° F.	—.0162	.00047
	10		1.0275	12	—.0105	.00050
	20		1.0222	32	.0000	.00054
	30	1.0169	1.0168	52	.0110	.00057
	35	1.0142	1.0141		.0132 Achard.	
	40	1.0114	1.0114	72	.0229	.00061
	45	1.0087	1.0086	92	.0355	.00065
	50	1.0058	1.0057	112	.0489	.00069
	55	1.0029	1.0029	132	.0633	.00074
	60	1.0000	1.0000	152	.0784	.00078
	65	.9971	.9971	172	.0946	.00083
	70	.9942	.9941	175	.0971	
	75	.9913	.9912			
	80 Gilpin. Phil. Trans. 1794.	9.882	.9882			
	100		.9758			
	120		.9639			
	140		.9496			
	160		.9358			
	180		.9214			

Expansion.

The formula used in the preceding Table is 113456—$(\frac{1}{4}f+101)^2$, the temperature being f°, or reckoning the degrees from 60, $1-.00058f-.000000625f^2$.

Investigations of M. Biot.

From a diligent comparison of the observations of De Luc, and other natural philosophers, M. Biot of the Institute of France has succeeded in discovering the law of the expansion of fluids; and by means of a very simple formula, he has been enabled to calculate the true dilatation corresponding to any given temperature. These interesting investigations have not yet been published; but M. Biot has had the kindness to communicate to the Editor a general account of his labours.

In all fluids whose expansions have hitherto been examined, the true dilatation δT reckoned from 0°, is capable of being expressed by the formula

$$\delta T = aT + bT^2 + cT^3,$$

T indicating the temperature, and a, b, c, three co-efficients constant for each liquid, but varying in different liquids. M. Biot has determined the value of these co-efficients for eight or ten fluids, which are most frequently employed. The preceding formula is applicable with equal accuracy at all temperatures, while the fluid exists in some state of fluidity, and continues to be heated. It may, therefore, be extended even beyond ebullition, if the fluid is contained in a tube where it cannot boil. The preceding formula likewise agrees with a set of fine experiments made by M. Charles, with an instrument of his own invention, for rendering sensible, and measuring the maximum expansion of water. A full account of M. Biot's investigations, will be found in the third volume of the *Memoires d'Arcueil*, which is now in the press; and also in a complete treatise on natural philosophy, with which M. Biot is at present occupied, and to the appearance of which we look forward with the highest expectations.

Expansion.

Investigations of M. Biot.

On the Expansion of Gases.

Expansion of Gases.

The subject of the expansion of gases, has been investigated by Priestley, Roy, Saussure, Monge, Guyton, Duvernas, and Prony; but the most accurate are those which have recently been made by Gay Lussac, and our countryman Mr Dalton. The results obtained by some of these eminent chemists, are given in the following Table drawn up by Dr Thomas Young.

Table of the Expansion of Gaseous Bodies.

Gases.	For 180°.	For 1°	
Dry air, 1. at 32°	7 6	.00209	Mean of six observations, Lacaille making it .04, Mayer 046, Bonne .0477, Shuckburgh .0505, Bradley 0544, and De Luc .047, for the expansion. From 32° to 54.8°: the mean .0476. De Luc.
Do.	.377		Mayer's refractions. Gilbert.
Do.	.370	.00206	Lambert.
Do.	.388	.00216	De Luc, reduced by Gilbert.
Do.	.381	.00212	Luz.
Do.		.00214	About 95°. Luz.
Do.		.00210	About 172°. Luz.
Do.	(.484)	(.00243)	Roy; but moisture was admitted.
Do.	.357	.00198	Schmidt: thinks it perfectly uniform, becoming 7. at 392°.
	.400	.00222	La Place, Systeme du Monde.
	*.378	.00210	Gay Lussac, corrected for the expansion of glass, = .003 or .0035.
	.393	.00218	Dalton, reduced by Gilbert.
		.00224	About 95°. Dalton.
		.00212	About 172°. Dalton.
Air, 2½ times as dense as usual	(.434)	(.00241)	Roy.
Moist air, as dry air.			When additional moisture is excluded. Saussure.
Hydrogen gas.			All as air. Gay Lussac, and Dalton.
Oxygen gas.			
Azotic gas.			
Carbonic acid gas.			
Muriatic acid gas.			
Sulphureous gas.			
Nitrous gas.			
Vapour of sulphuric ether.			

It follows from these experiments, that all the gases undergo the same expansion from the same increase of temperature, the expansion for each degree of Fahrenheit being $\frac{1}{483}$ according to Dalton, and $\frac{1}{480}$ according to Gay Lussac. An account of the expansion of the vapour of water, will be found in our article STEAM.

For farther information on this subject, see Ellicott, *Phil. Trans.* vol. xlvii. p. 185. Ferguson's *Lectures*, vol. i. p. 20. Smeaton, *Phil. Trans.* vol. xlviii. pt. 2. p. 612. Roy, *Phil. Trans.* vol. lxxv. p. 473. Troughton, *Nicholson's Journal*, vol. ix. p. 225. Wollaston, *Phil. Trans.* 1805. Croune, *Birch's Hist. of Royal Soc.* vol. iv. p. 263. De Luc *Recherches sur les Modifications de l'Atmosphere*, tom. i. p. 225. Biot *Memoires d'Arcueil*, tom. 3. (not yet published). Lefevre Gineau *Mem. de l'Institut.* Dalton, *Manchester Memoirs*, vol. v. p. 59. Dalton, *Nicholson's Journal*, vol. x. p. 95; xiii. 377; and xiv. p. 128. Hope, *Edinburgh Transactions*, vol. v. p. 379. Gough, *Nicholson's Journal*, vol. xiii. p. 189. Mushet, *Phil. Magazine*, vol. xviii. p. 1. Gay Lussac, *Annales de Chimié*, tom. xliv. p. 87, or *Nicholson's Journal*, Oct. vol. iv. p. 207. Brewster, *Phil. Trans.* 1814, part 2, and 1815, page 1. Young's *Natural Philosophy*, tom. ii. page 390. See also Chemistry, vol. vi. p. 35. (β)

EXPECTATION of Life. See Annuities.

EXPONENTS. See Algebra.

EXPORTATION. See England.

EXPRESSION. See Painting.

EXTENDED Thirds, in Music, according to Mr Marsh, *Theory of Harmonics*, p. 20, are the same as the "wolf thirds," or those on which the greatest imperfection or result of the temperament falls: usually on ♯Gc, Bbe, ♯F♭B, and ♯CF, in the major thirds; ♭E♯F, ♭B♯c, and F♯G, in the minor thirds. (ϱ)

EXTRACTION of Roots. See Arithmetic and Algebra.

EXTREME Intervals, in Music, are, according to Dr Callcot, "such diatonic distances as are increased or diminished by a chromatic semitone," (*Gram.* 1st edit. p. 113,) and this alteration at page 112, is defined to be the same with a *flat* or a *sharp*; yet, except in the obscure and incorrect section (228) in p. 119, the study is no where advised by this author, that sometimes the *minor*, and at others the *medius* semitone (𝒮 or 𝔖) is his *chromatic* semitone. Dr R. Smith, and Mr Liston, (*Essay*, p. 24.) denote all those intervals *extreme* with respect to C, which arise in modulating therefrom by fifths, either above ♯G, or below ♭E. The several *extreme flat* intervals of the above authors when arranged, are ♭II, or 2 (—𝔖), ♭3 (—𝔖), ♭4 (—𝒮); ♭IV, or 4 (—𝔖); ♭V, or 5 (—𝔖); ♭VI, or 6 (—𝒮), ♭7 (—𝒮,) and ♭VIII, or 8 (—𝔖).

And the several *extreme sharp* intervals are, ♯1 (+𝔖), ♯II (+𝒮), ♯III (+𝔖), ♯V (+𝒮), ♯VI (+𝔖), and ♯VII (+𝒮). To which may perhaps be added the *extreme double flat* interval ♭♭VII, or ♭7 (—𝒮—𝔖); and the *extreme double sharp* interval ♯♯1 (𝒮+𝔖), and ♯♯4, or ♯IV (𝒮+𝔖).

The letters 𝒮 or 𝔖, and their signs + or —, denoting the increase or diminution of the interval, by $36\Sigma+f+3m$, or $47\Sigma+f+4m$ respectively, whence the value of any of them may be easily had; or see the several intervals Eighth, Fifth, First, &c. (ϱ)

EXTREME Diminished and *Extreme Superfluous* intervals, according to Mr Chambers, are diminished or increased by 2𝒮; but Mr Overend says by 𝒮+𝔖, which answers to the double flattening or double sharpening above. (ϱ)

EYE. See Anatomy, Medicine, Optics, Physiology, and Surgery.

Eylau.

EYLAU, *Preussisch*, or *Prussian*, a small town in East Prussia, south-east of Koningsberg, of little note till it became the scene of a most sanguinary engagement between the French and Russians, on the 8th February 1807. The Russian army having retreated during six days, reached on the 7th February the position behind the town of Eylau, where general Beningsen had promised to his impatient followers to give battle to Bonaparte. The ground was chosen, less from a consideration of its being favourable to the Russians, than with a view to the preservation of the city of Koningsberg. The length of the position was two miles; it was partly flanked by woods, but, on the whole, the ground was elevated and exposed. The French took post on ground nearly parallel, but higher, so as to command with their artillery the Russian position. The French had likewise the superiority in numbers, the Russians not exceeding 60,000 men. On the evening before the battle, there was a most sanguinary struggle for the town of Eylau, which finally remained in possession of the French. The armies passed the night in the immediate neighbourhood of each other, and eager for the approaching conflict. The cannonade began at day break, and was conducted at first with greater effect on the part of the French, in consequence of the Russian line standing more exposed. The space between the armies, though marshy in open weather, was easily passable at this season of ice and snow. Bonaparte accordingly made two large columns move forward, the one against the centre, the other against the right of the Russians; but after advancing 300 yards, the havoc of the Russian artillery was so great as to break their order, and they returned in confusion. A subsequent effort directed against the Russian left, was equally unavailing, the Russians advancing and driving back their opponents with the bayonet.

These operations, however, were merely preparatory to Bonaparte's general attack. Calculating that Davoust, whom he had detached to take the Russians in the rear, would arrive at his station towards noon, Bonaparte directed a general movement of his army, including the guards, in six separate columns against the Russian line. A heavy fall of snow concealed his arrangement, and favoured the approach of the columns, so that they were not discovered till they had come very near to the Russian line, upon which general Beningsen, aware of the importance of the moment, made his reserve advance, join themselves to the main body, and rush forward, with united strength, to charge the enemy. The French were shaken, gave way, and all the efforts of their officers to rally them were ineffectual. Their cavalry attempting to turn the fortune of the day by desperate charges, were cut up in great numbers; but the Russians had hardly effected this repulse, when they were ordered to face about, a numerous corps appearing on their left, and threatening their rear. This was the corps of Davoust, who had fortunately been retarded by the wretched state of the roads. The Russian main body was drawn back from the field of battle to meet him; and a Prussian corps under general Lestocq having, after a most difficult march, reached the scene of action, advanced to attack Davoust. Their number did not exceed 6000; but they were admirably commanded by Lestocq, and the Russian left wing affording them support, the French were repulsed with very heavy loss. Night now came on, and Bonaparte recalled Davoust. Had the Russians been in a condition to make an attack the next day, their success would have been certain; but their ammunition was expended, and their men were fainting for want of food. By an irregularity unfortunately too common in the Russian commissariat, there had been no supply of provisions that day; and Benningsen, apprehensive for the eventual safety of Koningsberg, took the determination of retreating, contrary to the concurrent wish of his generals. The Russians acknowledged a loss of nearly 20,000 men in killed and wounded, and maintained that that of the French exceeded 30,000. Bonaparte remained for some time at Eylau, but finding that the Russian cavalry were competent to the protection of the surrounding country, and that he could make no effectual progress against so resolute an enemy, he retired in the direction of Dantzic. (χ)

F.

FABIUS. See ROME.

FACE. See DRAWING.

FACULÆ. See ASTRONOMY.

FAENZA, the *Faventia* of the ancients, a city of Italy, and capital of the department of the Amone, is the see of a bishop suffragan of Ravenna. Mr Eustace, the latest author of travels in Italy, describes this ancient town as spacious and well built. Its great square has a fine range of porticos on either side, and a Corinthian church belonging to the Dominicans. The cathedral, which is Gothic, stands in the great square, and is ornamented with a handsome steeple, five stories high, with ballustrades. There is a fountain near the church, having a bason surrounded with four lions of brass, and encompassed with a wrought iron rail. Faenza was once celebrated for its pottery, from which it received its name. The pottery obtained also the name of *Majolica*, from the inventor of it. Mr Eustace observed in the vicinity of this city, a few traces of the pine groves, which appear to have formed one of its distinguishing features in ancient times. Distance from Ravenna, 20 miles south-west. North Lat. 44° 18′, East Long. 11° 51′. See Keysler's *Travels*, vol. iii. p. 246; Eustace's *Classical Tour through Italy*, vol. i. p. 142, 143. (*w*)

FAHLUN, a town of Sweden in the province of Dalecarlia, is situated about 300 feet above the level of the sea, between the two lakes of Run and Warpen, in a small plain, surrounded on all sides by low hills. The town, which owes its existence to the celebrated copper mines in its neighbourhood, is very regular, and consists of several parallel streets, crossed at right angles by many others. The houses are principally built of wood and of stone, and there are two churches in the town built with brick, and one of them roofed with copper. The following very interesting and accurate account of the celebrated copper mine, is abridged from the full account given by Dr Thomson, in his recent travels in Sweden. "The mine of copper ore consisted of an immense cone of copper and iron pyrites, placed with its apex downwards. It has been wrought from time immemorial, and formerly with so little care, that about 150 years ago, the whole works fell in, leaving a great hollow, still very conspicuous as we approach the mine. Two large pillars, or rather hills of quartz, however, remained unmoved amidst the ruins. They may be still seen rising through the bottom of the great excavation, formed by the trembling of the mine. For many years galleries were driven through the old works, and the ore extracted in that manner; but now the vast heap of ruins has been wrought out, and they are obliged to go deeper for the ore which at present they extract. The mine is about 200 fathoms deep. The descent is by an easy winding staircase all the way; so that you may descend to the bottom without any other inconvenience than the fatigue of going down so many steps. The galleries are all spacious: none less than eight feet in height, and some as high as thirty feet. There are about 600 workmen in the mine. The ore is extracted partly by the mallet, partly blasted by gun-powder. It is extremely poor, seldom yielding more than 1½ per cent. of the copper. To the eye, indeed, it has nearly the appearance of iron pyrites. This pyrites is frequently mixed with beautiful crystals of actinolite, of considerable quantity, which gives it, when fresh broken, a very splendid appearance. This actinolite is likewise found in the neighbourhood in chlorite slate, crystallized in very regular four-sided prisms, about an inch in length, and having a greyish blue colour.

Whether the original great conical mass of ore constituted a vein or not, it is impossible to say; all means of tracing any thing respecting its situation having been long ago destroyed. But several veins filled with a similar ore still exist, and have been wrought.

The ore is drawn up the perpendicular shafts; the principal one of which is King Adolphus Frederick's shaft. All the machinery belonging to this mine is driven by water; and as far as my observations went, the whole is constructed according to very scientific and sound principles.

The whole wood-work of the mine is impregnated with sulphate of iron. The water that collects in the mine contains likewise a portion of the same salt in solution. As this water contains likewise a little sulphate of copper, it is pumped up, and made to run slowly through a pretty long trough, containing pieces of old iron. By this contrivance, the copper is precipitated. It is collected occasionally, and smelted. The water thus freed from copper, though it contains sulphate of iron, is by much too weak to render it profitable to crystallise the salt by means of heat.

It is concentrated by a very ingenious method, borrowed from the method used in Germany to concentrate some of their weak salt mines. The water is pumped up to the top of a pretty high wooden stage, all wrapt round with birch twigs. It is let fall upon these twigs, and trickles over them to a trough at the bottom of the stage prepared to receive it. By this contrivance, a very great surface of the liquid is exposed to the air, which greatly facilitates its evaporation. This process is repeated six or seven times, as the liquid moves along from one extremity of the stage to the other. By this time it is so much concentrated as not to be very far from the point of crystallization. From this stage it runs into a large vessel lined with lead, where it is sufficiently concentrated by boiling. It is then let into a number of small square wooden vessels, set beside each other in a large apartment for the purpose. Into each of these vessels a number of wooden rods fixed to a frame are dipped. Upon these rods the sulphate of iron crystallises. The copperas thus manufactured is used in Sweden, and exported to different ports in the Baltic.

The whole surface of the plain on which the mine is situated is thick, strewed with immense round blocks of granite, quartz, felspar, hornblende, and chlorite slate. But not a single rock is to be seen *in situ* in the whole plain, except the two pyramids of quartz, in the excavation of the mine formerly mentioned. But upon the higher grounds which surround Fahlun, especially to the west, rocks will be found exposed in considerable quantity. The rock which environs Fahlun is a particular kind of felspar, without exhibiting any quartz or mica which I was able to detect, though I pursued the course of the rock several miles. This rock is very much injured by the weather. I could not perceive any marks of stratification in it; but as the direction of the high ground is from south to north, that is the direction in which only it can be traced. I observed three great veins of hornblende cutting through this rock, and running in an easterly and westerly direction. In one of these veins there was a bed of quartz eight inches thick. Each of the hornblende veins must have been at least six feet thick. I observed likewise several veins of quartz not exceeding a few inches in thickness, running in the same direction with the hornblende veins.

The rocks on the east side of the mine, at the distance of some miles, are gneiss. From the minerals that accompany the copper ore, such as actinolite, tremolite, chlorite, and from several other circumstances, I have little doubt that the mine consists, in fact, of a series of veins in mica slate. The vein-stones appear to consist chiefly of quartz.

Fahlun is the oldest, and for many years it was the most productive, mine in Sweden. It is known to have been wrought since the year 1347. Nor is there any reason to believe the working of it began only then, though no authentic records go to a greater antiquity. In the year 1600 it yielded annually about eight millions of pounds of copper in the year; but for some time back, the produce has been greatly diminished, and there is every reason to expect that no great number of years will elapse before it ceases altogether to be productive. Those gentlemen who have the management of the mine, are sensible of this circumstance, and have been turning their attention to the iron mines in the neighbourhood, as a means of employing the workmen when the copper mine shall be exhausted. The governor of the province, who is himself possessed of some iron mines, and who conceives that the interference of those gentlemen would be injurious to his trade, has endeavoured to prevent them from carrying their views into execution.

The copper mine of Fahlun is at present the property of a considerable number of individuals. When the ore is brought to the surface of the earth, it is divided into different portions according to the requisite shares of each individual. Every one is at liberty either to smelt his own ore in the way he thinks proper, or to dispose of it to those who are inclined to purchase it. From this method of proceeding it happens that there are a great many different smelting houses, and that each house conducts its processes upon a small and economical scale." Population of the town 6000. See Coxe's *Travels*, vol. v.; Catteau *Voyage en Allemagne et en Suede*, vol. ii. p. 292, Paris 1810; but particularly Thomson's *Travels through Sweden*, chap. xii. p. 216; and Plates ix. and x. of that work, which exhibit a ground plan of the copper mine, and likewise a perpendicular section of it. (w)

FAHRENHEIT. See THERMOMETER.

FAIRFORD, a market-town of England in Gloucestershire, is situated in a pleasant country at the foot of the Cotswold hills, on the banks of the river Colne, at an old ford near the confluence of that river with the Thames. The town consists of two streets, neatly and regularly built, and is principally distinguished for its fine Gothic church, and the exquisitely painted glass which it contains. The church, which is dedicated to the Virgin Mary, is a fine specimen of the Gothic which prevailed about the end of the 15th century. It consists of a lofty nave, a chancel, side-aisles, and a low tower rising from the centre of the edifice, which has been supposed to have been intended for the foundation of a spire. The whole of the building, which is 120 feet long, and 55 broad, is embattled, and sustained by pinnacled buttresses, those of the tower being flattened, and gradually diminishing to the top. Statues, as large as life, are rudely sculptured on their bases; and round the architrave is a series of grotesque figures. The exterior is adorned with many niches, which had once contained carved statues. The architecture of the interior is remarkably fine: light fluted pillars, sustaining four arches on each side, divide the aisles from the nave. The aisles are continued parallel with the chancel, with which there is a communication by two arches of equal height. The chancel is encircled with a fine oak screen, adorned with finely carved tabernacle-work, and stalls of the same work. The pavement is chequered with blue and white stone.

This magnificent edifice was founded by John Tame, an opulent merchant, who having, in 1492, taken a vessel laden with painted glass, and bound from a Flemish port to Italy, resolved to have a large building erected for its reception. Having been for some time settled at Fairford, he began the present church in 1493, and disposed of the glass in 28 windows, each having four or more compartments. The principal subjects of these paintings are scriptural, some of them are the Roman emperors, who opposed and who favoured the establishment of Christianity. The designs in the great west window are the Resurrection and the Last Judgment, the colours of which are so brilliant, and the drapery so delicate, that Mr Dallaway regards them as a more pleasing specimen of ancient art than will often be met with in England or on the Continent. Vandyck considered some of the figures as so well done, that they could not be surpassed by the best pencil.

The church contains a variety of monuments and sepulchral inscriptions. A tomb of Italian marble is erected in the north aisle to the memory of Sir Edmund Tame, son of the founder of the church.

There is here a free school endowed for 60 boys, and other charitable institutions. The Colne is crossed by three bridges; and, about three miles from the town is the great canal which joins the Severn and the Thames. The inhabitants of Fairford chiefly subsist by its markets and fairs, which are well attended. The population of the town and parish, in 1811, was,

Number of inhabited houses,	295
Do. of families, ...	295
Do. employed in agriculture,	129
Do. in trades and manufactures,	133
Males, ...	688
Females, ...	756
Total population, ...	1444

See Rudge's *Gloucestershire*, and the *Beauties of England and Wales*, vol. v. p. 629—686. (j)

FAIFOE, or HAIFO, the name of a sea-port town of Cochinchina, situated on the banks of a river communicating with Turon Bay. The river was formerly navigable for large junks, but it will now admit only vessels of 100 tons burthen. The junks lie at the distance of about 8 miles from the town in another river

Faifoe, Fairhead.

communicating with that of Turon, and capable of receiving ships of 200 tons. The best anchorage is on the west side of the island of Cham Calloa, in N. Lat. 15° 54′, opposite the river, and about three leagues from the main. The town of Faifoe, which is about 10 miles from the sea, was once very large, and possessed a flourishing commerce. The houses were built of brick, and the streets well paved. It was destroyed by the rebels during the civil wars, but is now recovering its former importance. The vessels which arrive at Faifoe are principally Chinese, Japanese, and the country ships from India. A hundred Chinese junks are said to have come annually to Faifoe before its decline. The principal articles which they exported into Faifoe were alum, China ware, Congo tea, dried fruits, drugs, sticks of sandal wood, linen cloth, false pearls, ornaments, pepper of various kinds, dried blubber, dammer, ink, isinglass, sweatmeats, talc, lackered ware, and great quantities of tutenague, the last of which the king always engrosses to himself. The Japanese import chiefly copper, and several articles similar to those enumerated. The country ships import several European and Asiatic commodities, such as braziery, cutlery, cloths, guns and gunpowder, saltpetre, silver, clocks and watches, tobacco, opium, gold lace, brimstone, camblets, furs, glass ware, hardware, ironmongery, lead, looking glasses, mathematical instruments, piece goods, tin, sandal wood, swords, shot, and vermilion.

The exports from Faifoe to China were principally beetle nut, black wood, bullock's bones, calavances, cardamoms, cotton, dried sea snails, dried fish, drugs, pepper, Japan wood, powder, agala wood, beech de mer, birds nests, blue, (a kind of smalts), cassia, cloves and nutmegs, deer's sinews, mats of rattan, elephant's teeth and bones, fish glue, gamboge, coarse linen, rattans, wood for incense, seeds, skins of bullocks deer and elephants, stick lac, tin, wax, sugar, and sugar-candy in great quantities, which is reckoned the finest in the world. The exports to Japan were ebony, nammorack, pepper, fish skins in great quantities, hare-skins, cow hides, buffaloes horns, white and dark sugar, Cambodia nuts, bark, drugs, Sellaw, and silk stuffs. The exports to India are principally sugarcandy and sugar. Various articles are also exported to Batavia, Manilla, and Siam. The duty on all imports is 12 per cent.; and the master of every vessel must give in a statement of all his goods, and agree to pay a certain sum every time that the ship arrives. The Portuguese pay annually 3000 quans, (600 of which is equivalent to 2 rupees, or 1 Spanish dollar,) and the Chinese only from 1500 to 2000, according to the size of their junks. It is necessary to present the king with a piece of scarlet cloth, some fine long cloth, a sword, telescope, &c. and the principal mandarin at Hue, which is the royal residence, must also be attended to. See Milburn's *Oriental Commerce*, vol ii. p. 452. (w)

FAIRHEAD, is situated in the county of Antrim, near the north-eastern angle of Ireland, and opposite to the island of Rathlin or Raghery, in Long. 6° 2′ W. of Greenwich, and Lat. 55° 44′ N.

This bold headland is composed of the most considerable mass of greenstone in the British islands. The greatest thickness of the bed is 260 feet, and its elevation above the sea 545 feet. The greenstone rests on strata of sandstone, which dip south-west, and in these, a little to the west, the coal mine of Ballycastle is situated.

Fairhead, in consequence of its superior elevation, is distinguished, in the language of the country, by the name of Benmore; it forms the eastern termination of Ballycastle bay, and is distant about eight miles from the basaltic district of the Giant's Causeway, known to mariners under the general name of Bengore Head. Nothing can form a more striking contrast than these two headlands. Bengore is composed of a series of distinct beds, some of which are formed of columns which, for symmetry, vie with architectural precision; while the rest present the most rugged and irregular aspect. At Fairhead the bed of greenstone is continuous from top to bottom, and at the same time presents the appearance of columnar disposition; but this, on close examination, is found to be only an appearance, arising from the natural disposition of the greenstone to separate into distinct prismatic concretions, totally destitute of that uniformity of shape preserved in each individual column at the Giant's Causeway. Such, however, is the tendency of the greenstone of Fairhead to assume this structure, that some masses of not more than 20 or 30 feet in diameter, and nearly 200 feet in length, may be observed almost entirely detached from the rest of the rock, and their having, in some instances, swerved a little from the perpendicular, hang in awful suspense over the abyss below.

The action of the great current, occasioned by the flowing of the tide through the Irish Channel, which disgorges itself just at this point, where it is again met by the wave of the Atlantic, occasions a never-ceasing eddy along the shore of Fairhead, which prevents any accumulation of matter; and were its base not protected by the enormous fragments of greenstone which lie scattered over it, the soft material on which the promontory is supported would soon be washed away, and the whole launched into the ocean.

Even as it is, the barrier formed by these enormous blocks is not entirely sufficient to resist the inroad of the waves. From time to time great masses of the rock fall with a tremendous crash upon the debris below. In 1810, a fall of this kind took place; and, from the appearance of the cliff, others may be constantly expected. Within a few feet, and parallel to the edge, there are several long deep rents, into which cattle have sometimes been known to fall, and which, in many places, may be plumbed to the depth of sixty or eighty feet; these can only be occasioned by the undermining of the cliff, as they do not occur excepting along its edge.

The greenstone of Fairhead is like all other beds of the same substance, very fine grained, resembling basalt on the upper and the under surfaces, and very coarse grained in the middle of the bed. This peculiarity is distinctly displayed on the under surface of the mass, where it comes in contact with the sandstone; but as no overlaying strata occur immediately along the summit, it is only at some distance from it, that the fine grain is again observable. Fairhead dips a little west by south, and is overlaid by sandstone at the distance of about a mile from the sea.

According to Dubourdieu, a species of blindcoal, which promises to be a profitable return to the proprietors, has been found in the strata beneath the greenstone on both sides of Fairhead; and what is remarkable, he states that the blindcoal sells for 3s. per ton more than the blazing coal.

See the Rev. Mr Dubourdieu's *Statistical Survey of Antrim*; and Dr Hamilton's *Letters on the County of Antrim*. (s. n.)

4

FAIRY-RINGS, or *Circles*, is a name which has been given to spots or rings in grass fields, which are either barer than the rest of the field, or covered with grass more green and more luxuriant. Sometimes they consist of a bare ring, seven or eight yards in diameter, forming a round path, about a foot broad, and having green grass in the middle, and sometimes of a circumference of green grass, inclosing a circular portion covered with grass less luxuriant. Dr Priestley observed one about a yard in diameter, the ring itself being about a quarter of a yard broad, and equally so in the whole of its circumferences, but there was no appearance of any central spot.

Dr Hutton's observations.

Fairy-rings, or rather segments of them, were observed upon Arthur's Seat, near Edinburgh, in the year 1776, by Dr Ferguson, Dr Black, and Dr Hutton. They resembled the withered grass of a foot-path, but they traversed the shoulder of the hill in such a direction, as to correspond neither to a sheep-track nor a foot-path. Upon a near inspection, a narrow stripe of the grass appeared to be quite dead and withered. The breadth of the stripe was about nine, or in some places 12 inches; the sides of it were perfectly defined, without any gradation from green to withered grass, all the plants in the track being killed, without the contiguous part having suffered in the least. The length of the track was about 100 or 200 yards, "stretching from the south-east side of the southmost hill, through a hollow, and ascending obliquely the shoulder of the summit of Arthur's Seat, on the south-east side." Similar tracks of various extent were found in all the different aspects and situations, from the south side of the summit to the north side of the hill, half way down to the plain, but none at the bottom. Parallel to each of these tracks of withered grass, which appeared as if it had been made the year before, and was then black, from the grass having rotted, the distance of the old and new tracks was generally only a few inches. These tracks are not always continuous, but frequently consist of separate spots. The tracks were not only always parallel and similar, but the very spots which composed them were similar, as if the one had been a copy of the other. The brown colour of the new track was visible at the distance of 200 or 300 feet; and even at a greater distance there could be seen another stripe of a dark green, which was some dark green grass that had grown among the rotten grass in the last year's track. The greatest part, however, of the dark green was behind the last year's track, and was owing to a similar growth of grass in places where the grass had been formerly killed or withered, and which were now almost covered with new plants, which gave a deeper shade of green than the rest of the hill. Dr Hutton sometimes noticed five or six successions of tracks, but those which had been made above three or four years were much effaced. All the tracks were segments of large circles. From the observations which Dr Hutton made, it appeared that the "progress of the rings proceeded in the direction of a line drawn from the centre bisecting the segment, that is to say, those portions of concentric circles are never inscribed, but always circumscribed; and for this reason it will appear that those circles of which segments are exhibited to our observation, must be increasing and not diminishing in their diameter.

"In the spring, about the middle of the month of April, the grass begins gradually to wither and decay. It is perfectly dead in a little time, that is, in a week or two, and then appears white or withered. Thus, every plant being killed in the new track, those vegetable bodies exposed to heat and moisture gradually decay, so as next year to exhibit a dark or black, instead of a light or white track, which it had been the year before; but, during the second year, the dead plants are still observed in the turf, which, as it begins to get new plants, loses gradually the appearance of the old ones, until at last little more can be observed than a broad shade of a much deeper green, which, on the one side, is compared with the natural verdure into which it sometimes seems gradually to terminate; whereas, on the other side, the deep green colour of the ground formerly tracked, is contrasted with the yellow or light colour of the withered grass." After a careful examination of the appearances, Dr Hutton could think of no other mode of explaining them, than by supposing that they were produced either by lightning, or by the operation of insects.

Cause of fairy rings first explained by Withering.

Dr Price, Dr Darwin, and Mr Gough, without any plausible reason, ascribed these phenomena to lightning; but Dr Withering, with much more reason, accounted for their formation by the growth of fungi. He always found the spawn of the fungus below the brown and bare portion, by digging to the depth of two inches, whereas it was never found below those parts where the grass was green and luxuriant.

Dr Wollaston's observations.

Dr Wollaston has examined the subject of fairy circles with his usual ingenuity and success. He observed that the fungi or mushrooms, first noticed by Withering, were found solely at the exterior margin of the dark ring of grass. The breadth of the ring, in that instance, measured from them towards the centre, was about 12 or 14 inches, while the exterior ring, occupied by the mushrooms, was only about four or five inches broad. Dr Wollaston conjectured, from the position of the mushrooms, that the rings were formed after the manner described by Dr Hutton, by a progressive increase from a centre, and this opinion was strengthened by finding that a second species of fungus presented a similar arrangement, with respect to the relative position of the ring and fungi, the fungi being always upon the external margin of a dark ring of grass. "I thought it not improbable," says Dr Wollaston, "that the soil which had once contributed to the support of fungi might be so exhausted of some peculiar *pabulum* necessary for their production, as to be rendered incapable of producing a second crop of that singular class of vegetables. The second year's crop would consequently appear in a small ring surrounding the original centre of vegetation, and, at every succeeding year, the defect of nutriment on one side, would necessarily cause the new roots to extend themselves solely in the opposite direction, and would occasion the circles of fungi continually to proceed by annual enlargement from the centre outwards. An appearance of luxuriance of the grass would follow as a natural consequence, as the soil of an interior circle would always be enriched by the decayed roots of fungi of the preceding year's growth."

In opposition to the remark of Dr Withering, that he never could find any spawn of the fungi among the green grass, Dr Wollaston repeatedly observed undecayed spawn, even below the most luxuriant grass. "During the growth of the fungi, they so entirely absorb all nutriment from the soil beneath, that the herbage is for a while destroyed, and a ring appears, bare of grass, surrounding the dark ring. If a transverse section be made of the soil beneath the ring, at this time, the part

Dr Wollaston's observations.

beneath the fungi appears paler than the soil on either side of it, but that which is beneath the interior circle of dark grass, is found, on the contrary, to be considerably darker than the general surrounding soil. But, in the course of a few weeks after the fungi have ceased to appear, the soil where they stood grows darker, and the grass soon vegetates again with peculiar vigour, so that I have seen the surface covered with dark grass, although the darkened soil has not exceeded half an inch in thickness, while that beneath has continued white with spawn, for about two inches in depth."

The section of the space occupied by the white spawn, has, in general, nearly the same form, and may be compared to that of a wave, proceeding from the centre outwards, as its boundary on the inner side ascends obliquely towards the surface, while its exterior termination is nearly in a vertical position. The extent occupied by the spawn varies considerably, according to the season of the year, being greatest after the fungi have come to perfection, and is reduced to its smallest dimensions, and may, in some cases, not be discernible before the next year's crop begins to make its appearance.

For the purpose of observing the progress of various circles, I marked them three or four years in succession, by incisions of different forms, by which I could distinguish clearly the successive annual increase, and I found it to vary in different circles, from eight inches to as much as two feet. The broadest rings that I have seen, were those of the common mushroom, (*ag. campestris*); the narrowest are the most frequent, and are those of the champignon (*ag. orcades* of Dr Withering). The mushroom accordingly makes circles of the largest diameter, but those of the champignon are most regular. There are, however, as many as three other fungi that exhibit the same mode of extension, and produce the same effect upon the herbage. These are the *ag. terreus*, *ag. procerus*, and the *lycoperdon bovista*, the last of which is far more common than the two last-mentioned agarics.

There is one circumstance that may frequently be observed respecting these circles, which can satisfactorily be accounted for, according to the preceding hypothesis of the cause of their increase, and may be considered as a confirmation of its truth. Whenever two adjacent circles are found to interfere, they not only do not cross each other, but both circles are invariably obliterated between the points of contact; at least, in more than twenty cases, I have seen no one instance to the contrary. The exhaustion occasioned by each, obstructs the progress of the other, and both are starved.

I think it also not unworthy of observation, that different species of fungi appear to require the same nutriment; for in a case of interference between one circle of puff balls and another of mushrooms, they did not intersect; but I cannot say positively that I have seen more than one instance.

I once found that a tree had interrupted the regular progress of a circle; but this appeared to be only a temporary impediment, as the extension had proceeded at the usual rate; and by passing obliquely from each side into the soil beyond the tree, had given the ring the form of a kidney, so that another year or two would probably reunite the two extremities into one curve surrounding the tree. Being desirous of ascertaining in what length of time a soil might again recover the power of producing a fresh crop of fungi, I cut a groove, in one or two instances, along the diameter of a mushroom ring, and inserted a quantity of spawn taken from its circumference, with the hope of seeing it vegetate for some distance near the centre; but the experiment failed altogether, as I shortly after quitted my residence in the country."

Mr Wilson ascribes fairy rings to the action of grubs, which are said to lie concealed under the ring among the roots of the herbage; and he supposes, that the fungi give a preference to these rings, on account of the abundance of dead vegetable matter to be found in them.

Mr Florian Jolly supposes, that fairy rings, and the fungi which they contain, are owing to the excrements of horses, diluted by the rains, and imbibed by the soil. See Jessop, *Phil. Trans.* No. cxvii. p. 391; Hutton, *Edinburgh Transactions*, vol. ii. p. 1—11; Withering's *Arrangement of British Plants*, vol. iv. page 222, 3d edit. Gough, Nicholson's *Journal*, vol. ix. p. 3; Wilson, *Id.* vol. xiii. p. 1; Florian Jolly, *Id.* vol. xiii. p. 93, 415; *Monthly Magazine*, vol. xv. p. 219; Gilbert's *Journal*, vol. xvii. p. 351; and Wollaston, *Phil. Trans.* 1807, p. 133, or Nicholson's *Journal*, vol. xix. p. 367. (*w*)

FAITH. See THEOLOGY.

FAITH, CONFESSIONS OF. See CONFESSIONS.

FAKIR, or FAQUIR, from the Arabic *Fakar*, signifying a poor person, is a kind of dervise, or religious beggar, very common in Eastern countries. They sometimes travel alone, or in troops of 200 or 300, having a superior, who is distinguished by his habit.

The Fakirs never work, but subsist solely by the alms which they receive abundantly from the superstitions of the people. They go entirely naked, carrying on their shoulders a thick club, the end of which is wound round with rags of cloth of all colours. They strew their hair, which hangs half way down the back, with ashes, with which they sometimes besmear their whole bodies. They are not allowed to marry. "They generally take up their abode," says Stavorinus, "in shady places, either in the open air, or in old and ruinous buildings, without using any thing to repose upon, or to cover themselves. Genuine Fakirs make vows that they will perform penance by remaining during their whole lives in some unnatural or uneasy posture, or by torturing their bodies by various methods; but most of them are not excited by real penitence or compunction, but are spurred on by vain glory, endeavouring to attract the notice and respect of the commonalty, and thereby to raise themselves to esteem and honour. I met with several of them at different times. Among others, were some who, by keeping one arm stretched out upwards for many years, had lost the power of lowering it again, and were forced always to remain in that position. Others who had made choice of bending their body forwards, and who were in consequence grown so crooked, that they formed a right angle. Some who, by continually bending the head backwards, could not bring it back to its natural position. There were others, again, who dragged heavy iron chains about with them during their whole lives."

In another part of his voyages, Stavorinus informs us, that he met with the ruins of a stone building in which a Fakir had taken up his residence. He sat entirely naked, by a slow fire, in the middle of the ashes. His long and black hair was clotted with ashes and dirt, and he had imposed upon himself the horrid penance of thrusting through the glans of the penis a brass ring, of about the thickness of a quill, and three inches in diameter. The Bengalese women think that sterility may be cured by a particular species of devotion to this disgusting object. Besides this ring, Stavorinus observed three other rivetted iron rings linked to it, which might weigh altogether about 2½ pounds. When the Fakir walked, the whole of these rings hung loose, without seeming in the least degree to incommode him.

Stavorinus describes another Fakir at Surat, who had imposed upon himself a silence of twelve years, ten years of which had already elapsed. He was about 30 years of age, and well made. He was covered with a white dust, made of the ashes of burnt cow-dung, and his hair and beard were filled with that dust. In the large hut where he resided, there was a niche opposite to where he sat, which contained an image three feet high, carved out of one piece of a black shining stone, and representing a man in armour, with four arms. The Gentoos paid the greatest respect to this Fakir.

It would be a waste of time to give an account of the various tortures by which these Fakirs seek for reputation. Tavernier informs us, that some of them never sit or lie down to sleep, but support themselves by a rope hung down for that purpose. Others lay fire on their heads, and burn their scalps to the very bone; others roll themselves naked on thorns, while some bury themselves in a pit or ditch for nine or ten days, without tasting food or drink. D'Herbelot reckons that there are about 800,000 Mahometan Fakirs, and 1,200,000 idolatrous ones in the Indies. See Tavernier's *Travels*, and Stavorinus' *Voyage to the East Indies*, vol. i. p. 133, 142; and vol. iii. p. 147. (*j*)

FALCO. See ORNITHOLOGY.

FALCONER, WILLIAM, an ingenious poet, of obscure parentage, of whom little more is known than his genius and his misfortunes. He was a native of Scotland, and is supposed to have been born in one of the villages on the coast of Fife; but his parents, in consequence of some domestic misfortunes, removed to a sea-port town in England, where they both died of an epidemical disorder, leaving their son, an orphan, in destitute circumstances. Having been bred to the sea, he spent the greatest part of his life upon that element, in very subordinate stations. In such unfavourable circumstances, it is difficult to conceive how he could have found leisure, means, or opportunity, for acquiring that knowledge and taste, and for cultivating those poetical talents, which he afterwards so conspicuously displayed. On this subject, the scanty memoirs of his busy and obscure life, afford us little or no information; and we are left to conclude, that Falconer possessed one of those ardent and vigorous minds which seem destined to surmount every obstacle opposed by adversity, and to rise into eminence by their own natural elasticity. The late ingenious editor of he works of Burns, however, informs us, that Falconer, while serving on board a man of war, attracted he notice of Campbell, the author of *Lexiphanes*, who engaged him as his servant, and having discovered his alents, took pleasure in promoting his instruction.

In the year 1751, he published, at Edinburgh, *A Poem, Sacred to the Memory of Frederick Prince of Wales*, which displayed considerable powers of versiication, but attracted little notice. In 1762, appeared *The Shipwreck, a Poem, in three Cantos, by a Sailor*; production which has insured to Falconer an eminent ank among the British poets. This poem, which is ounded on real incidents, commemorates the principal ccurrences during a voyage from Alexandria to Veice, in which, having suffered shipwreck, the author scaped with only two others of the crew. It was inscribed to Edward Duke of York, brother to his present Majesty, and was very favourably received by the public.

Through the influence of his royal patron, whom he further complimented by "*An Ode on his second departure from England as Rear Admiral*," Falconer obtained the lucrative situation of purser of the Royal George, one of the finest ships in the British navy. It was probably from motives of gratitude, that he was now induced to enter the field of political controversy; and having enlisted under the banners of the party of "King's Friends," he published a satirical piece, entitled, "*The Demagogue*," in which he inveighed against Mr Pitt, (afterwards Earl of Chatham), and his adherents.

In 1764, he gave a second edition of the Shipwreck, with considerable additions, having extended it to the length of about one thousand lines more than the former. In 1769, he published "*The Marine Dictionary*," in one volume 4to; a work of considerable utility; and, about the same time, he gave a third edition of the Shipwreck, with some alterations.

Towards the close of the year 1769, he embarked, with several East India supercargoes, on board the Aurora frigate, with the view of endeavouring to improve his fortune abroad. This vessel, however, was never heard of after her departure from the Cape of Good Hope, in the month of December; and there is no doubt that she must have foundered at sea, and gone down with all her crew.

The title of Falconer to the name of a poet, is sufficiently established by his Shipwreck. The subject was new, and eminently capable of poetical effect; and the poem derived additional interest from the reality of the incidents which it described. The professional knowledge and poetical powers of the author, enabled him to do ample justice to his theme; and the originality, pathos, and melodious versification of the Shipwreck, have secured for it a place among the standard and popular productions of the British muse. (*z*)

FALCONRY. See HUNTING.

Situation.

FALKIRK, is the principal town of the eastern district of Stirlingshire, and is beautifully situated on an eminence above the Carse and the Frith of Forth. The whole scenery of the river Forth is delightful, and that part of it which is seen from Falkirk is rich as well as diversified, and never fails to captivate and astonish strangers. Taking Falkirk for a centre, you are presented towards the north with a prospect in the form of an amphitheatre, which extends every way to the distance of ten or twelve miles.

Toward the west, it is bounded by the termination of the Campsie hills, and the high grounds above Denny; on the north by the Ochil hills; and on the east by the Saline hills, part of the coast of Fife, and the rising grounds above Bo'ness. This view comprehends Stirling castle on the north-west; and there is an opening in that part of the prospect, which runs far back into the north, and presents you with the bold risings of Benledi, and other parts of the Grampian mountains. The level parts of this prospect consist chiefly of the Carses of Falkirk, and other alluvial lands upon the banks of the Forth, which are so justly celebrated for their value and fertility. This landscape is diversified and interesting, by the flourishing iron works at Carron, the Frith of Forth, and the great Clyde and Forth canal. These, together with the ancient seats of neighbouring gentlemen, the villas and villages occasioned by the vast population of the district, taken in connection with the ships and vessels passing to and fro, give the whole scene an air of grandeur and activity, seldom to be met with, but in the neighbourhood of large commercial towns.

When Falkirk is viewed from the north, it is seen at a great distance, and is conspicuous for an old tower connected with the church, and an elegant spire 140 feet high, lately erected in the middle of the town. This view of Falkirk is grand, on account of the bold risings of the ground behind it; and seen from the north-west, it is peculiarly striking by the Callander wood, or part of the ancient forest of Caledonia, which forms the back ground.

The situation of this town is no less healthy than beautiful, and it is well supplied with water, which is conveyed to it by pipes. Standing on an eminence, it has a free circulation of air; and having a declivity on every side, it is easily kept dry and comfortable. The houses are, in general, well built, and though it has risen to consideration without a plan, yet it is more regular than might have been expected. It consists of several streets and lanes; and the principal one, though narrow toward both ends, where the ports were formerly situated, yet upon the whole it is commodious and regular. The inhabitants of the town may be reckoned about 4000 persons. The population of the parish is about 10,000, and includes the thriving port of Grangemouth, which is the opening from the Frith and eastern seas into the great canal.

Population.

That port has lately been favoured with the establishment of a custom-house; and the revenue received at that office for the last quarter has been stated at £30,000, and the preceding one not much less. But these sums far exceed any former receipts, and are chiefly to be ascribed to the prodigious number of vessels pouring into that harbour, after so long a stagnation of trade, by the inconveniences of a protracted warfare. But though such returns of revenue are not to be expected in continuance, yet Grangemouth is a thriving village, and is likely to rise in importance.

Police.

Justice of the peace courts are regularly held in Falkirk, and also occasionally other meetings respecting the turnpike roads, or the particular business of that quarter of the shire. It is the market town of a population not less than 25,000 persons; and yet there is not a magistrate in the town, nor a place of confinement where a culprit may be shut up for a single hour. In these circumstances disorders occasionally ensue, as must frequently be the case in populous districts; but instances of violence and outrage are exceedingly rare, and the general deportment of the people shows their quiet and peaceable disposition.

Falkirk was formerly a burgh of regality; and the different trades had acquired certain privileges and immunities; and the office of the stint-masters is a residue of the powers which the burgesses formerly acquired. When the feudal jurisdictions were taken away, after the rebellion of the year 1745, Falkirk was converted into a burgh of barony; but a baron bailie is seldom appointed, and the town is thus deprived of the protection which he might afford.

While Falkirk was a burgh of regality, it was furnished with a jail and court-house by the noble family of Callander; but after the honours and possessions of that family were forfeited, they were suffered to fall into ruins, and the site and materials being sold, the whole is now converted to another purpose. The general advantage of a place of confinement in a populous situation like this has long been felt, and there are now measures pursuing, for having a lock-up house, or a place of confinement, legally established in Falkirk. It has also been proposed to have a sheriff-substitute appointed; but as this project would probably meet with resistance, it would perhaps be more expedient to have a police bill for the town and parish of Falkirk, investing the bailies thereof with powers to act as justices of the peace for the county of Stirling, which would afford ample means of order and protection.

Falkirk being 24 miles from Edinburgh, and not much less distant from Glasgow, has advantages in point of trade, which towns that are nearer those large cities do not enjoy. Though there is no species of manufacture carried on but for the use of the country, unless it be some trifling branches of the cotton trade, together with leather and shoes, it is but occasionally that the people of this district purchase from Glasgow or Edinburgh, and therefore the shops of Falkirk are well provided with the conveniences as well as the necessaries of life. It has long been noted for one of the best butcher meat markets in the country. But as there are no magistrates, and few means of public improvement, there are no shades, nor proper market-house, for exposing it to sale.

The same want of accommodation is severely felt by the farmers, who bring their grain to market on the Thursdays. Falkirk has its full proportion of fairs, and there are three trystes, or great cattle markets, which are held in its neighbourhood on the second Tuesday of August, the second Tuesday of September, and the second Tuesday of October annually. These are more numerously attended, and more business is done in buying and selling cattle and sheep, than at any other similar markets in the kingdom. A few horses also are bought and sold.

Markets.

Being the centre of so numerous a population, there is a great variety of dissenting chapels in Falkirk, but none of the episcopal persuasion. There is only one parish church, and one minister of the establishment. The church is large, and was built a few years ago after the Gothic form, according to a plan by Mr Gillespie; but it has no pillars nor arches in the inside. Falkirk was of great consideration in ancient times; and the parishes of Denny and Muiravonside were pendicles connected with it. In the year 1724, a portion of the parish of Falkirk was erected into a parish, and denominated Polmont. A considerable part of it was at the same time added to Hamanon and Cumbernauld. *Reg. Mag. Sig.* Edin.

Ecclesias- cal state.

It appears that the church of Falkirk had been founded by Malcolm Canmore, one of the kings of Scotland, A. D. 1057. The property and right of presentation belonged to the archbishop and chapter of St Andrews, till that religious body conveyed them to the monastery of Holyroodhouse in the year 1166. That celebrated convent was founded by King David in the year 1128, and if not the first, was one of the earliest in Scotland. Consistent with the credulity of the times, the reason assigned for its erection was a vision, which was said to be seen by the king in a moment of danger while he was hunting, and on the spot where the vision appeared the monastery was built.

History.

It was called the Abbey of the Holyrood, because upon that festival day the supernatural appearance was seen, and because the stag, which seemed to attack and

Falkirk.

threaten the life of, the king. vanished from his sight, and left the semblance of a cross. In memory of this occurrence, a black cross was deposited in the monastery, and being supposed to have a powerful influence n times of emergency, King David Bruce wore and ost it at the battle of Durham, upon the 17th of October 1346. The monks of Holyrood-house belonged to the order of St Augustine, and were lodged in the castle of Edinburgh, till the monastery was ready for heir reception, to the exclusion of the nuns, who had hitherto resided in that part of the castle. Several charters of Malcolm IV. are dated from the monastery, *Sanctæ crucis de castello puellarum.* * See *Dipplomat. vet. Advoc. Lib.* vol. i. p. 292, et 294.

The abbey of Holyroodhouse acquired lands from he kings of Scotland, and pious subjects, till it became exceedingly rich, and had estates in the counties of Edinburgh, Linlithgow, Stirling, and Peebles, together with churches in various other parts of Scotland. The power of the Popish adherents had long been on he decline; and, while the affairs of the nation were unsettled, the rich endowments of the church were obained by friends and favourites of the crown. Adam Bothwell, bishop of Orkney, acquired the possessions of Holyroodhouse, in the year 1582, perhaps in commendam; and in A. D. 1587, with the consent of the onvent, they were given in feu farm to Sir John Ballenden of Auchnoul, Lord Justice Clerk.

John, Lord Bothwell, son of the Bishop of Orkney, ucceeded his father as commendator of Holyroodhouse, nd he, with consent of the surviving members of the monastery, (for the fraternity were much diminished in umber, and none being permitted to enter,) were preailed upon, for certain considerations, to surrender the whole of the property of that monastery into the hands f the king; and it was granted in full farm and absoute property, to Sir Lewis Ballenden, son of Sir John, nd called the barony of Broughton. On the death of Sir Lewis in the year 1591, the property devolved upon Sir James, his son, who conveyed a part of it, the barony of Abbots-kerse, A. D. 1606, to his kinsman, he seventh Lord Livingston, and the first Earl of Linithgow. The barony of Abbots-kerse comprehended he greater part of the old parish of Falkirk, before Polmont and other parts were separated from it. It ncluded also other lands and possessions in the couny of Stirling; but though the barony of Abbots-kerse was conveyed to the family of Callander, yet considerable parts of it were disposed of to other persons, by the amily of Ballenden.

The town of Falkirk appears to have had its beginning under the protection of Holyroodhouse, and the oldest part of it was erected in the vicinity of the church. The Livingstons of Callander having acquired property, at an early period, in what were called the ands of Falkirk, encouraged building, and extended he town. When the abbot's property was added to the barony of Callander, that noble and munificent family cherished the town, and secured the affections of the nhabitants, till their titles and possessions were forfeitd, for the support which they gave, in the year 1715, o the claims and pretensions of the Stuart family, from whom they had received their honours, and the most of heir wealth.

Falkirk was formerly denominated *Ecclesbrae,* and perhaps it was so denominated by being situated upon an eminence, when few or no houses were near it. The name of Falkirk seems to have been of a later date, and was probably derived from the Latin word *vallum*, a wall or rampart, and the Scotch word *kirk*, meaning the church upon the wall, for in truth the Roman wall, or Graham's dyke, ran along the south side of the town, and even through the ground on which a part of it is built. One of its more early names seems to have been *Eiglisbrec,* which is a Gaelic denomination, signifying the *spotted church*; and, in conformity to this, in ancient writings and charters, it is called *Varium Sacellum*, or more commonly, *Varia Capella.* In the charter of the Archbishop and chapter of St Andrews, to the convent of Holyroodhouse, A. D. 1166, it is denominated *Eiglisbrec,* and *Varia Capella.* It is only in subsequent times and documents that we hear of Falkirk.

Falkirk being on the boundary between the Caledonian and Roman possessions, was the scene of many sanguinary conflicts; and at Camelon, in the immediate neighbourhood, there was a Roman station of some note. About the beginning of the 5th century, while the Caledonians, under the conduct of Robert Graham, a friend or connection of King Fergus II. were repelling some incursions of the Roman forces, the gallant Graham lost his life; and from the eminence of his character, the Roman wall of Severus, or as most will now have it, of Antoninus, was from that time known by the name of Graham's dyke.

When the south aisle of the old church of Falkirk was lately taken down, a small piece of marble was found with the following inscription in barbarous Latin:—

FVNERATVS
HIC . DEYN
ROB . GRAHAM
ILLE . EVERSUS
VALL . SEVERUS
AC . LIS
FERGVSIVS . II.
R . SCO.

This inscription, like many others, must have been made long after the event, but it shews, that Graham was buried in the church-yard of Falkirk, and it appears from the inscription, that the Roman wall that runs from the Forth to the Clyde, was at one time called the wall of Severus.

Toward the end of the 13th century, a severe battle was fought between the army of King Edward of England and the Scottish forces, upon the plain below Falkirk, and scarcely half a mile distant from the town. Among the Scottish troops were Sir John de Graham, Sir John Stuart, Cumyn, and Wallace the celebrated champion of Scotland. That there might be some jealousy among those illustrious generals, is not inconsistent with the infirmities of human nature; but it is not ascertained, on good authority, that the fortune of the day was injured by any fault of theirs, (*Dalrymp. Annal.*) notwithstanding the different opinion which some historians have expressed; but upon that memorable day, De Graham and Stuart were killed in battle, and both of them were buried in the church-yard of Falkirk. Till of late the grave of Sir John Stuart was only distinguished by a stone, shaped like a coffin, and without a name; but now his name and fate are inscribed upon the stone. Sir John de Graham's was originally marked by a sculptured figure in human form. At three different times, stones supported by pillars, were placed over his grave, one above another, by the care of relations, namesakes, or friends, and the last was erected by William Graham, of Airth, Esq. A. D. 1773.

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* "David Rex Scotiæ templum et monasterium longe magnificentissimum fundavit canonicis regularibus, A.D. 1128, in suburbis Edinurghi. Ubi die festo venatus, percussus a cervo dum cornu comprehenderet, crucis imaginem non cervi cornu vidit, eodemque loco cœnoium erexit. *Diplom. vet Advoc. Lib.* vol. i. p. 279, 280.

In the beginning of the year 1746, a battle, or rather skirmish, was fought between the king's forces and the Highland troops, in the interest of the Stuart family. The king's forces were routed, and fled toward Linlithgow; the Highlanders took possession of the town of Falkirk, and conducted themselves with a considerable degree of order and moderation, though they knew that the people in general were hostile to their views. A monument was erected in the church-yard of Falkirk, over the bodies of Sir Robert Monro, bart. of Foulis, and his brother the Doctor, who were both killed in the field of battle.

The Callander estates, after the forfeiture of that noble family, were sold to the York Buildings Company; and when their affairs had run into disorder, they were exposed to sale by the authority of the Court of Session, and purchased by William Forbes, Esq. a native of Aberdeen, who is the present proprietor. (J. W.)

Situation.

FALKLAND ISLANDS, a group of islands in the Atlantic Ocean, situated at the utmost extremity of South America, and about 80 leagues from the Straits of Magellan. Two of them are of considerable extent, being more than 70 leagues in circumference; and lie between 51° 10′ and 52½° South Latitude, and between 58° and 62° West Longitude.

Discovery.

These islands were first seen by Captain Davis, who sailed under Sir Thomas Cavendish in 1592; next by Sir Richard Hawkins in 1594, who called them *Hawkin's Maidenland*, in honour of Queen Elizabeth; in the year 1598, by Sebald de Wert, who named them Sebald's isles, and they are so designed in all the Dutch charts; in 1683, by Dampier, and probably about the same time by Cowley; in 1689, by Strong, who gave them their present appellation in honour of Viscount Falkland; in 1699, by a Frenchman named Beauchesne Gouin; and in 1721, by Roggewin, a Mecklenburgher in the Dutch service, who circumnavigated the whole group, and called it Belgia Australis. The Dutch mistaking the numerous capes for portions of different islands, gave to the whole the designation of New Islands; the French generally call them Malouines, from the people of St Maloes, whom they wish to consider as the first discoverers.

History.

The navigators of the last mentioned nation were, without question, the first settlers on these islands, when their government, after the loss of Canada, in 1763, selected them as a new American settlement, particularly as a place of shelter and refreshment for vessels bound to the South Seas. A colony of Acadian families, above twenty-seven persons in all, was carried thither in 1764, by Commodore Bougainville; and in the following year, by the addition of new colonists, the number of inhabitants amounted to about 150. In the beginning also of the year 1765, Commodore Byron, in conformity to his instructions, took possession of these islands in the name of his Britannic Majesty; and a British colony was settled, the year after, in Port Egmont, by Captain Macbride, who circumnavigated the whole coast. But they were soon found to be of very little value, particularly from the total want of wood; and first the French ceded their settlement to the Spaniards in 1767, and the English abandoned theirs in 1774. They are now employed by the Spaniards as a receptacle for criminals from their American dominions.

Aspect.

The two largest of these islands are separated by a channel about twelve leagues in length, and one to three in breadth; and were furnished with the most secure and capacious harbours. Port Egmont, on the north-west coast of the largest island, is described by Byron, as one of the finest havens in the world, and as capable of containing the whole British navy in perfect security. The general aspect of the coast is rocky and desolate; and no kind of wood has been found on any part of the islands. They appeared to the first navigators, while sailing along the shores, to be completely covered with trees; but these, upon a nearer approach, were discovered to be nothing but bushes of tall rushes and reeds, which grow in clusters to the height of three feet, and then shoot out other stalks about six or seven feet in length. The higher lands are covered with heath, and there is great abundance of excellent turf for fuel, capable even of supplying sufficient heat to a forge. There is no appearance whatever of those islands having ever been inhabited previous to their discovery by Europeans; and the navigators, who first landed upon their shores, found the animals so unacquainted with man, that the birds suffered themselves to be taken with the hand, and even settled upon the heads of the people when they stood still.

Soil.

The surface is marshy, and the soil is composed first of a thick turf, then a black mould, from eight to twelve inches deep, and next a yellowish clay, resting upon strata of slate and stone. In most places on the coast is stone fit for building; and, in the interior, there is earth capable of being manufactured into bricks and potter's ware. The rocks are chiefly of quartz, with some pyrites, and marks of copper. Red and grey slate, and different kinds of ochre, are common; but no mines or metals have been discovered.

Climate.

The climate is temperate and salubrious, free from the extremes of heat or cold; but there are frequent rains and stormy winds in all seasons of the year. The running streams are never frozen; and the ice on the lakes and pools is seldom sufficiently strong to bear the weight of a man, above twenty-four hours in succession. Snow remains upon the tops of the highest mountains about two months in winter; but seldom above a day or two in the lower grounds. The hoar frosts in spring and autumn occasion no injury to the plants, but, being thawed by the sun, are converted into a refreshing dew. Thunder is seldom heard in summer; but, even during that season of the year, the winds are almost uniformly violent; and, from the want of fuel and shelter, all the settlers have suffered greatly from cold.

Tides.

A remarkable peculiarity has been observed in the tides, which do not rise at settled periods subject to calculation; but just before high water, the sea, in less than a quarter of an hour, rises and falls three times, as if shaken up and down, and this motion is always more violent during the solstices, equinoxes, and full moons.

Vegetable productions.

The surface of the ground is partially covered with turf, shrubs, and a variety of plants. The turf, which is found chiefly above the clay soil, is formed of the roots and emains of plants in marshy situations, and is frequenty seen in strata of considerable thickuess. The meadows, which are of great extent, and watered with numerous rivulets from the hills, afford abundance of exellent pasturage. One of the most common grasses grows to the height of six feet, and furnished the colonists with an excellent thatch for their houses, while its stalk, which was very sweet and nourishing, was preferred by the cattle to every other kind of food. The resinous *gum plant* is the most conspicuous and urious of the vegetable productions. It is of a bright reen colour; but, having neither stalk, branches, nor leaves, it is more like an excrescence from the earth han a plant. It is only about a foot and a half in eight, but frequently more than six feet in diameter; nd so firm in its texture, as to bear the weight of a man without yielding to the pressure. On its surface re drops of a tough yellowish matter, about the size f pease, resembling resin, and of a strong aromatic mell like turpentine. A small shrub, creeping close o the ground, was discovered to possess the taste of pruce fir; and, being made into beer with molasses, proved a powerful antiscorbutic. Here are great uantities also of wild parsley, wood-sorrel, and waterresses, which provide a valuable relief to those who re afflicted with the scurvy. The only fruits found upon these islands, capable of being used as food, are small berry about the size of a pea, resembling the *cet* of North America, and another similar to the *mulberry,* both of which grow upon creeping plants. Among numerous flowers, only one appeared to yield ny perfume, and its smell resembled that of the *tubeose.* The shores are covered with sea-weeds so strong and thick as almost to prevent the landing of a boat. The tides throw up several coralines, the finest mother-of-pearl, sponges of the most compact texture and delicate fibre, and a variety of shells, of which the most curious is a bivalve called *la poulette,* said to be found no where else except in a fossil state. Only one species of quadruped was observed on these islands, called the *wolf-fox,* from its resemblance to both these animals. It is about the size of a common shepherd's dog, with very long sharp fangs; and barks in the same manner, but not so loud. It digs a kennel under ground, and preys upon the wild fowls and seal. Great numbers of these animals were seen by Byron, who describes them as remarkably fierce, running even from a great distance, to attack the sailors, and plunging into the sea after the boats. The coasts abound with seals and walrusses or sea-lions, many of which are of an enormous size, and also very formidable from their ferocity and strength. Land and water fowls are found in great numbers and variety. The most remarkable are *swans* with necks of a velvet black colour, flesh-coloured feet, and white bodies; *wild-geese,* one species of which, similar to the Canada goose, feeds chiefly on dry land, and affords a wholesome and palatable food; *ducks* and *teals,* resembling those of Europe; a species of *grebe,* of the most beautiful plumage, and eyes like rubies, surrounded with a circle of white feathers; a kind of *guillemot,* whose flesh is very good to eat, and which the colonists destroyed in great quantities, merely with sticks in their hands; a species of *penguin,* distinguished by its stately gait, its beautiful plumage, and solitary habits; different kinds of petrels, small eagles, falcons, owls, snipes, curlews, herons, thrushes, &c. There were few kinds of fish taken by the settlers and navigators, but the most common were mullet, gradeau, sardine, transparent pike, and a fresh water trout of a green colour, without scales. There is no want of muscles, cray-fish, crabs, shrimps, and other small shell-fish; but they were found very inferior to those of Europe in taste. See Byron's *Voyage round the World in 1764, &c.;* Bougainville's *Voyage in 1766;* Pernetty's *History of a Voyage to the Malouines.* (q)

FALLING Bodies. See Dynamics.

FALLING Stones. See Meteorites.

FALLOPIAN Tubes. See Anatomy.

FALLOW. See Agriculture.

FALMOUTH, a sea-port town of England in Cornwall, of modern erection, its charter being granted by Charles II. in 1661. Its rise and increase has been altogether owing to the progress of commerce, and particularly to the establishment of packet boats for America, the West Indies, Spain, Portugal, Brazil, &c. Its harbour is accounted the finest in England, next to Plymouth and Milford Haven, and being land-locked, it affords complete protection in tempestuous weather. The town, situated at the bottom of an eminence which commands the harbour, consists of one street, nearly a mile in length, extending along the side of the beach. The pilchard trade is an object of considerable importance to this as well as to other parts of Cornwall. Pendennis castle, a building of much older date than the town of Falmouth, stands on a lofty rock, joined to the main-land by a narrow neck, and defends the west entrance into the harbour. The rock is three hundred feet above the sea, and appears to rise from the bay like an island. This fortification was begun by Henry VIII. and improved in some measure by Elizabeth, but more by Oliver Cromwell, having been much damaged during the civil war. It is now modernized, and mounted with seventy pieces of cannon. St Mawe's castle is a much smaller and less remarkable erection, standing on the eastern side of Falmouth harbour, and tracing its origin likewise to Henry VIII. The houses in the neighbourhood, though few in number, constitute a Cornish borough, while Falmouth, in consequence of its comparative recency of growth, is unrepresented in parliament.

Outside of Falmouth harbour there is a safe and commodious roadstead for vessels of the largest size. It is the opinion of many naval men, that the value of Falmouth, as a seaport, is not yet fully known. Its great advantage lies in its easy egress to the Western Ocean, the difficulty of which from Portsmouth, and even from Plymouth, is experienced every season by our outward bound vessels. Now from Falmouth the distance to the Lands-end is less than from the Thames to the south Foreland; there are neither shoals nor sand banks by the way, and it is highly important to consider, that the French side of the Channel terminates on the meridian of Falmouth, so that if a vessel going from that port gains a league of westing in her southward progress, she is forthwith received by the ocean. Were the wind to get round to the westward the day after her leaving Falmouth, the vessel has still a clear course of more than four hundred miles to the southward before meeting with land, viz. the north-east coast of Spain. The difficulty of getting into the ocean from Portsmouth or Plymouth, will be apparent on computing the small number of days in the year during which the wind is fair to come down the Channel. On examining a diary, we shall find that sixty or seventy days in the twelvemonth are rather above than below the average. In 1808 the expedition under Sir David Baird sailed from

Falmouth on the 9th of October, and entered Corunna on the 15th; but two transports leaving Plymouth the same day for a similar destination, got no farther than Falmouth by the time the expedition was on the coast of Spain. In 1811, the Menelaus frigate, bound on a special service to the Mediterranean, was detained at Plymouth at the time that nine packets were kept at Falmouth by contrary winds. On the 27th October, the wind becoming northerly, the frigate and packets sailed from their respective anchorages; seven of the packets proceeded in spite of wind and weather, while the Menelaus and the two other packets were forced back. The principal objection to Falmouth is the difficulty of getting out during the prevalence of south-east winds; but these are of rare occurrence compared with the south-west winds, which form the great impediment to coming down Channel. It is however to be acknowledged, that the remote situation of Falmouth, and the inferior degree of hazard to an enterprizing enemy who might venture on an attack, is an objection to rendering it an arsenal or dock-yard.

The following is the statistical abstract for the town of Falmouth for 1811:

Inhabited houses	465
Families that occupy them	1017
Families employed in agriculture	10
Ditto in trade and manufactures	427
Males	1453
Females	2480
Total population in 1811	3933

W. Long. 5° 2′ 5″, N. Lat. 50° 8′, according to trigonometrical observations. See *Beauties of England and Wales*, vol. ii. p. 442; and Manderson's *Letters on Falmouth.* (χ)

FALONICHI, or Felanix, is the name of one of the largest and best built towns in the island of Majorca. It is situated on the eastern coast, about three leagues from Santagni. The inhabitants grow plenty of corn, and have a sufficient number of cattle. Their chief wealth, however, is derived from their brandies, which are reckoned the best in the island, and form one of the most advantageous branches of commerce of Majorca. The monks of St Augustine have here a handsome convent. About half a league from this village, is a small hill called San Salvador, on the summit of which is a chapel, where the islanders pay their devotions to an image of Christ. There is an inn near the chapel for the accommodation of pilgrims; and an ascent has been cut in the rock to the top of the hill. Population 5000 or 6000. See St Sauveur's *Travels through the Balearic and Pithyusian Islands*, chap. 1. (*j*)

FAMAGUSTA. See Cyprus, vol. vii. p. 537.

FAMINE. See Abstinence and Fasting.

FANDANGO, the name of a national Spanish dance, which is practised only among the lower classes; an account of it will be found in Townshend's *Travels;* Ulloa's *Voyage to South America*, vol. i. p. 39; but particularly in Laborde's *View of Spain*, vol. v. page 257. (*w*)

FANO, *Fanum Fortunæ*, is the name of a sea-port town of Italy, in the duchy of Urbino. It is a well built and very handsome town, surrounded with a lofty wall of brick, having towers at a small distance, and bastions towards the sea. The churches are remarkable both for their architecture, and for the paintings which they contain. The triumphal arch erected in honour of Augustus, who sent thither a colony called Julia Fanestris, is now one of the gates of the town. It is of the Corinthian order; and in the time of Constantine, a gallery or portico of 5 arcades was built over it. It was greatly injured by the artillery, in a contest between this town and Julius II. Several pillars were still lying, (when Mr Eustace visited the town,) as they seem to have fallen on the platform above the arch. There are three different inscriptions on the three cornices. The theatre was formerly a magnificent and commodious building, but it has now the appearance of a ruin. The Via Flaminia here turns from the sea towards the Appennines. See Eustace's *Classical Tour in Italy*, vol. i. p. 153. (*w*)

FANTIN is the name of a county in the west of Africa, which extends about 30 miles along the gold coast. The capital, which is also called Fantin, is about twelve miles from the coast. Fruits, maize, and palm wine, are produced in abundance. There are numerous small towns on the coast, which are inhabited by about 4000 fishermen. The principal towns and villages are Anamaboa, or Anamabou, where the English have a fort; Adja, or Aga; Great and Little Cormantin, or Kormentin; Agua, Laguyo, Tantim, Guers, and Maufran. See Anamaboa, and Labarthe's *Voyage a la Coté de Guinée*, Lett. viii. p. 69. Paris, 1803. (*w*)

FAOUE, or Fouah, is the name of a town of Egypt, situated on the west branch of the Nile, and about 20 miles from the sea. It was formerly a large and flourishing city, and contained several commercial establishments belonging to Europeans. The ancient edifices, however, are now in a state of ruin, and the place is falling rapidly into decay. It is supposed by some to be the Metelis, and by others the Nancratis, of the ancients. The surrounding country is rich, and the gardens produce fine fruit, which is held in great estimation. East Long. 31°, North Lat. 31° 10′. See Lord Valentia's *Travels*, vol iii. p. 443. (*w*)

FARCE. See Drama.

FAREHAM, a market-town of England in Hampshire, is situated at the north-west extremity of Portsmouth harbour. The houses are tolerably well built. There are two meeting-houses and one church, which stands at the entrance to the town. The inhabitants are principally employed in the manufacture of sacking, and ropes for shipping, of which they send great quantities to the dock-yard at Portsmouth. In the summer season, this town is much frequented as a bathing-place: a commodious bathing-house has been lately erected. Vessels of considerable burden are built at the quay. There is here a good market on Wednesday, and an annual fair on the 29th of June, which is supplied with corn, cheese, hops, &c. The town also carries on a considerable coal-trade. The following is the statistical abstract for the town and parish, in 1811:

Inhabited houses,	596
Families that occupy them,	698
Do. employed in agriculture,	255
Do. in trades and manufactures,	179
Males,	1592
Females,	1733
Total population in 1811,	3325

See *Beauties of England and Wales*, vol. vi. p. 308. (*w*)

Farey's Temperament.

FAREY'S EQUAL TEMPERAMENT OF THE MUSICAL SCALE. The apparent simplicity of the ISOTONIC *Scale*, wherein the octave is supposed to be divided nto 12 exactly equal semitones, and its agreement with the vulgar notions of our musical notation, have occasioned an unusual number of theoretical writers o give their opinions in favour of this system: The names of more than 20 such authors are before us, many of whose recommendations of it are most unqualified: yet few of them have been at the least pains to inquire as to the *harmoniousness* of its concords, or otherwise; leaving these to be inferred from its semitones, which are discords!—the *length of string* calculated for sounding each note, having usually been thought fully sufficient information to the musical student;* at the same time it has been, and may fairly yet be questioned, whether this system has, in one single instance, been actually tuned on an instrument, with sufficient accuracy for judging fairly of its practical effects in performance.

It was for removing this defect of information, as to a scale so simple and elementary as the Isotonic, that the gentleman whose name appears at the head of this article was induced to pay considerable attention to a system, which he was convinced was at best but a most violent and unnatural simplification of a subject vastly more profound and extended, as Mr Liston has since proved, in his admirable "Essay on Perfect Intonation;" and it was in the course of this investigation, hat Mr Farey discovered a new *regularly tempered* system, having its fifth G ※ E ♭, less than each of its other eleven equal fifths, by what Mr Overend has denominated the most *minute* (m), the last interval that he or any other person has yet discovered, and being insensible, perhaps, in the nicest experiments in harmonics. None of its semitones differ from each other more than this very small quantity m, and the whole of them have finite or determinate ratios, expressible by help of the primes 2, 3, and 5; and, lastly, each of its notes may actually *be tuned* (on an organ having a sufficient number of pipes, like the Euharmonic organ of Liston) by the means of untempered or *perfect concords* only. That is to say, if on C (on a spare range of pipes) the five successive perfect fourths CF, FB♭, B♭E♭, E♭A♭ and A♭D♭, be very correctly tuned upwards, and from the highest of these notes, descending again by two perfect fifths, D♭G♭, and G♭F$_*$※, and a major third F$_*$※G$_*$ (which notes, in Farey's artificial commas, are, 0, 254, 508, 762, 1016, 1270, 912, 554, and 357, respectively), the last of these sounds, G$_*$†, or G according to the common notation, is the proper fifth above C, in this system. After this, new G has been transferred to the range of pipes intended to be tuned, a new beginning is to be made at this note, and 5-4ths up, and 2-Vths and a IIId down, are to be carefully tuned for obtaining D, a proper new fifth, (357 as before) to G. From this D, A is to be tuned in like manner, and likewise E, B, F※, C※ and G※ in succession. This process is then to be discontinued, and a new beginning made from C, by tuning upwards the three fifths CG, GD, and DA′, and the major third A′C※, and thence downwards, the four minor fourths C※G′※, G′※D′※, D′※A′※, and A′※F*, which last note (being the same with Mr Liston's E′※) is the proper fourth of this system, *i. e.* in Art. Com. 358, 716, 1074, 1271, 1017, 763, 509, and 255. Upon F*, two other schisma-excessive fourths are to be tuned in succession, as above, for B♭ and E♭; and thus eleven fifths will be obtained, each equal 5-4ths—2 V—III, and a resulting one, G※E♭, equal 29 V+11 III—48-4ths. Its fourth CF*, and complementary fifth F*C, being *found ready tuned on Liston's organ*; and whereon also there are 14 other pairs of notes, at the exact distance apart of this fourth, and 14 fifths (their complements), which agree exactly in their quantity therewith, but not with their places in the scale, as Mr Farey has observed in the *Phil. Mag.* vol. xxxix. p. 422, note.

In order fully to exemplify this system, and shew clearly its almost perfect agreement with the *Isotonic* or perfectly equal temperament, we subjoin the following Table, consisting of 11 columns, numbered at top, and entitled at bottom, because intended to be read upwards, according to the practice of musicians.

1	2	3			4	5	6	7	8	9	10	11
C	612	1	1	0	.5000000	480.0000	0	0		0	0	
B	561	—12	23	—5	.5297295	453.0613	24.4551	17.9658	2.0464	1.5330	28.5507	20.5644
B♭	510	6	—8	2	.5612318	427.6307	23.0595	16.9766	1.9315	1.4470	26.9183	19.4103
A	459	—7	14	—3	.5946022	403.6312	21.7871	16.0239	1.8229	1.3658	25.4866	18.3206
G※	408	—20	36	—8	.6299568	380.9785	20.5644	15.1075	1.7149	1.2893	24.0085	17.2752
G	357	—2	5	—1	.6674194	359.5940	19.4103	14.2758	1.6240	1.2169	22.6614	16.3218
F※	306	—15	27	—6	.7071036	339.4128	18.3206	13.4591	1.5330	1.1488	21.3892	15.3907
F	255	3	—4	1	.7491541	320.3618	17.2752	12.7183	1.4470	1.0839	20.1655	14.5412
E	204	—10	18	—4	.7936981	302.3820	16.3218	12.0048	1.3658	1.0232	19.0556	13.7251
E♭	153	8	—13	3	.8408981	285.4091	15.3907	11.3307	1.2893	.9657	17.9658	12.9548
D	102	—5	9	—2	.8908974	269.3913	14.5412	10.6946	1.2169	.9115	16.9766	12.2275
C※	51	—18	31	—7	.9438695	254.2725	13.7251	10.0828	1.1488	.8604	16.0239	11.5298
C	0	0	0	0	1.0000000	240.0000	12.9548	9.5278	1.0839	.8120	15.1075	10.8986
Notes	Artif. Commas.	V	4	III	Lengths of Strings.	Vibrations in 1″ of time.	Flat 3rds.	Sharp IIIds.	Sharp 4ths.	Flat Vths.	Flat 6ths.	Sharp VIths.
		Tunable Intervals.					Beats in 1″ of time.					

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* Even Dr Robert Smith has bestowed too little attention on this much recommended system, contenting himself with mentioning, (Harmonics, 2d edit. p. 166), that its harmony "is extremely coarse and disagreeable;" and has, at p. 167, erroneously stated the temperaments of its V, VI, and III, to be 1-10th, 7-10ths, and 6-10ths of a comma, instead of 1-11th, 8-11ths, and 7-11ths, respectively, which temperaments may nevertheless be very nearly obtained, from his col. 1. of Table II. in p. 158, viz. 7-76ths, 56-76ths, and 49-76ths, nstead of 7-77ths, 56-77ths, and 49-77ths, as above.

† The asterisk reversed, or at the bottom of the line $_*$, is here, and will hereafter be used, to denote the *fall* of the interval *schisma* or

The 1st, 2d, 4th, and 5th, of the above columns, seem to require no explanation. The numbers in the 1st, 2d, and 3d range of col. 3, shew how many Vths, 4ths, or IIIds, respectively, are to be tuned *upwards*, and the numbers with — affixed, of the same intervals, are to be tuned *downwards* respectively from tenor cliff C, in order to produce each several note.

The numbers in the 6th to the 11th columns, (calculated by our 4th Theorem in the article BEATS), shew the number of beats in a second of time, made by each several concord, 3d, IIId, 4th, Vth, 6th and VIth, above the note on the same line in col. 1, either *flat* or *sharp* beatings, as is marked at the bottom of the columns: and hereon it may be proper to remark, that the beats on all the VIths above D, are repetitions of those of their complementary 3ds from C to G※, and the remaining beats from C to D are the halves of those of their complementary 3ds; also the beats of the 6ths below E, are the same as those of the IIIds from C to G※, and the remainder are double of those of their complementary IIIds; and the beats of the 4ths from C to F※ are the same as their complementary Vths from F to c, and the remainder are double of their complementary Vths respectively.

In order to shew, in different ways, the extremely near agreement of the above system with the Isotonic, (which agree in col. 2), it may be proper to state, that in lengths of *strings*, the greatest difference (on G※) is but .000037, and the mean of all the differences only .000017; that in the *vibrations*, the greatest difference (on G※) is .0022, and the mean difference only .0006. With respect to the *beats*, which offer by far the most accurate mode of judging of the practical effects of any two systems, it may be proper to compare together the sums of the beats of each concord, in each system, as follows, viz.

	3ds.	IIIds.	4ths.	Vths.	6ths.	VIths.	Totals.
J. Farey's System,	217.8058	160.1667	18.2339	13.6639	254.2596	183.1550	847.2849
Isotonic, ...	217.8068	160.1699	18.2413	13.6659	254.2546	183.1527	847.2912
Greatest difference,	B♭ .0171	B .0130	E♭ .0092	G※.0092	B♭ .0201	※.0126	.0063
Mean difference, .	.0001	.0003	.0006	.0002	.0004	.0002	.0001

—by which, the very insensible differences of these two equal temperaments will sufficiently appear; the beats differing but 1 in 50, in the most extreme case, the 6th or B♭. (ε)

FAREY'S NOTATION OF MUSICAL INTERVALS. This new mode of expressing the magnitudes of intervals having been adopted in our work, it may be proper to say a few words in this place on the discovery of this notation. The late *Mr Marmaduke Overend*, organist of Isleworth Church, near London, and author of "a brief account of, and an introduction to, *Eight Lectures in the Science of Music*, (intended) to be read," &c. 4to. pp. 20. Payne & Son, 1781, bestowed inconceivable pains and labour on the calculations and comparison of musical intervals, by actual involutions, multiplications, &c. of the terms of their ratios, never using logarithms, and but rarely resorting to the indices of the component primes, for shortening his work: he adopted a consistent nomenclature throughout, according to which he named the several intervals, and fixed on a symbol or character for each, as we have done in our 30th Plate in Vol. II. and throughout our work.

At the conclusion of each of his arithmetical calculations, as above, Mr Overend was careful to express his results in form of equations, by means of his symbols, and to transcribe the whole neatly into thick quarto volumes. After Mr Overend's death, Dr John Wall Callcott, one of the most able but unfortunate of musicians, having purchased all Mr Overend's manuscripts from his family, kindly offered the use of the above mentioned quarto volumes to Mr Farey, with permission to make all such extracts from, and use of their contents, as he might be able. In perusing 14 of these volumes, in June 1807, Mr Farey found an immense number of intervals correctly deduced by Mr Overend, and expressed in his symbols, which no previous writers had noticed, the whole of which he was desirous of preserving, in an arranged Table; but previous to this, it became necessary to reduce them all *to some one notation*; a thing which never seemed to have occurred to Mr Overend, but who had in each instance left his intervals expressed, in the symbols of those particular intervals, which he happened to have used in calculating their ratios.

In order to avoid negative signs, which are indispensible in the use of such large intervals as S, t, and T, the smallest that any writer had previously used as the terms of their notations, it occurred to Mr Farey to select the three *smallest intervals* that Mr Overend had discovered, viz. đ, f and m; but this notation, as well as that by F, f and m, proving to have negative signs to m, in every instance, as remarked in our article COMMON MEASURES of Musical Intervals, he next tried Σ, f and m, which has been found in its most extended use, the best adapted by far, than any others of the numerous ones subsequently tried, for a general notation of musical intervals; and, as such, we have in our work adopted and used it.

The methods by which Mr Farey at first deduced the expression for each interval † in his notation, from the multifarious ones of Mr Overend, were far from the most direct or easy; but, *assuming* the notes of the common chord, III, V, and VIII, to be known to be $197\Sigma + 4f + 17m$, $358\Sigma + 7f + 31m$, and $612\Sigma + 12f + 53m$, respectively, as may easily be proved to be true, by either the indices of the primes, or the logarithms of these intervals, in our Table, Plate XXX. Vol. II. by adding together 197 times Σ, 4 times f, and 17 times m, and so of the others, the following resolutions and compositions would readily give us his expressions for all the intervals in the Table: thus,

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Σ, (to be read "fall schisma,") and the asterisk in its usual position *, to denote the rise of a schisma, (to be read "rise schisma"); so the asterisk and grave united, *\`, will denote the fall of a *minor comma* or €, and *' the rise of the same interval: and, in like manner, *' will denote the rise of the *diaschisma* or đ, and *\` the fall of the same interval, attached either to the literal or the numerical marks of intervals. See NOTATION of Musical Intervals.

† And he marked the same at the time, in pencil, in Mr Overend's volumes, where they still remain, in the library of the *Royal Institution* in Albemarle Street; to which public body Dr Callcott soon after presented those curious manuscript volumes.

		Σ	f	m
4th	VIII—V	254	5	22
3d	V—III	161	3	14
T	V—4	104	2	9
t	4—3	93	2	8
S	3—T	57	1	5
c	T—t	11	0	1
L	S—c	46	1	4
P	T—L	58	1	5
	4 c	44	0	4
r	L—4 c	2	1	0
Σ	P—S	1	0	0
f	r—2 Σ	0	1	0
m	c—11 Σ	0	0	1
Whence the remaining intervals may be compounded, as follows,				
χ	r + Σ	3	1	0
ƒ€	χ + Σ	4	1	0
ƒc	ƒ€ + Σ	5	1	0

		Σ	f	m
R	χ+r	5	2	0
R	c—ƒc	6	—1	1
d	R—R	1	—3	1
F	d+2f	1	—1	1
€	c—Σ	10	0	1
φ	€+f	10	1	1
đ	C+Σ	12	0	1
D	χ+c	14	1	1
π	D+Σ	15	1	1
ℰ	c+€	21	0	2
ƒ	D+c	25	1	2
δ	ƒ+Σ	26	1	2
ʃ	δ+R	32	0	3
S	t—S	36	1	3
S	L+Σ	47	1	4
S	S+c	68	1	6
4 ℰ	7đ+m	84	0	8
3 ʃ	8đ+m	96	0	9
T	T+c	115	2	10

After several hundred intervals, expressed in this new notation, had been collected from Mr Overend's MS. and many other sources, and arranged in a Table, ccording to their magnitudes, as before mentioned; it was observed, that all but a very few of them, formed a *regular series*, in which each of the three columns ormed a separately *increasing series* of numbers; such, hat f, 1, 2, 3, 4, &c. first appeared with Σ, 23, 80, 127, 74, 231, 278, 325, 382, 429, 486, 533, 590, 637, &c. espectively; and *m*, 1, 2, 3, 4, &c. first appeared associated with Σ, 8, 19, 34, 44, 55, 66, 76, 91, 102, 112, 23, 138, 149, 159, 170, 185, 195, 206, 217, 227, 242, 253, 263, 274, 289, 300, 310, 321, 336, 346, 357, 368, 378, 393, 404, 414, 425, 440, 450, 461, 472, 482, 497, 508, 518, 529, 544, 554, 565, 576, 586, 601, 612, 622, 633, 648, 658, 669, &c. respectively. The intervals of he commencement of the f's, being sometimes S and ometimes S, commencing with 23 Σ + f + 2 m; and the ntervals of the beginnings of the m's, either C, € or π, commencing with 8 Σ + m's, by help of which the musical student may readily construct for himself a Table of the above 71 *regular intervals*, and their logs, which we must reluctantly omit here for want of room.

All such intervals in Mr Farey's general Table, as do not conform to the above, with regard to the number of 's and of m's that they contain with their Σ's, have been denominated *irregular intervals*, such as *d*, F, *r*, *χ*, *ƒ€*, *ƒc*, R and R, none of which ought to have either f or m, but consist of Σ's only, to constitute them regular ntervals; so φ, D, and π, ought to have no f; and *ƒ* to have an f, and only two m's, &c. and these changes may be effected, and any intervals be brought into a regular form, by means of decimals in the schisma column, equivalent to the f's or m's, that may be added or taken away; reckoning each f as .14966096 Σ, and each m as 00786241 Σ; thus, for example, *d* in a regular Table, will be .5588795 Σ, φ = 10.149661 Σ + m, *ƒ* = 11.8582014 Σ + f + 2 m, &c.

If we consider, that whenever the prime number 2, s found involved or multiplied in the numerator, or east term of any musical ratio, it is equivalent to deducting an octave $\frac{1}{2}$ from it; and if, in the denominaor, it answers to the addition of VIII; so 3 denotes the subtraction or addition of a major twelfth ($\frac{1}{3}$); 4 of a double octave ($\frac{1}{4}$); 5 of a major seventeenth ($\frac{1}{5}$), &c. it will thence appear evident that a Table of the intervals , $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{5}$, &c. expressed in the new notation, will enable us to find the expression for any interval whose ratio is given. We can, on the present occasion, only find room, for the first 25 numbers of Mr Farey's Table of this kind, viz.

Farey's Notation.

Nos.	New Notation.		
	Σ	f	m
2	612.00000	12	53
3	970.	19	84
4	1224.	24	106
5	1421.	28	123
6	1582.	31	137
7	1718.06077	34	148
	1718.05290	34	149
8	1836.	36	159
9	1940.	38	168
10	2033.	40	176
11	2117.10204	42	183
12	2194.	43	190
13	2264.73073	44	196
	2264.58107	45	196
14	2330.05290	46	202
15	2391.	47	207
16	2448.	48	212
17	2501.53067	49	216
	2501.53181	49	217
18	2552.	50	221
19	2599.72902	51	225
20	2645.	52	229
21	2688,06077	53	232
	2688.20257	52	233
22	2729.25171	53	236
	2729.24384	53	237
23	2768.46027	54	240
24	2806.	55	243
25	2842.	56	246

From this Table the primes 7, 11, 13, 17, 19, &c. and their multiples, are not excluded, because intervals involving these do sometimes require to be calculated: the reason why two values are affixed to 7, and to some others of the primes differing by m or f, is, in order that a *regular* interval may be made between every adjacent number, as $\frac{8}{7}$, $\frac{1}{2}$, $\frac{6}{7}$, $\frac{7}{8}$, &c. A simple subtraction will give the value, whenever the terms of the ratio are found in the first column; and when this is not the case, the multipliers of each term must be sought, and the corresponding notations of each added together, and then the sums are to be subtracted; thus if the value of the minor tone, $\frac{9}{10}$, were wanted, we have its ratio $\frac{3^2}{2\times5}$, and

$$\begin{array}{rrrcrrr} 970 & 19 & 84 & & 612 & 12 & 53 \\ 970 & 19 & 84 & \text{and} & 1421 & 28 & 123 \\ \hline 1940 & 38 & 168 & & 3033 & 40 & 176 \end{array}$$

the difference of which sums, is, 93 Σ + 2 f + 8 m, the value sought.

Since, in the use of this notation, a carrying or borrowing to or from one column to another, never takes place, in whole numbers at least, as with columns of pounds, shillings, and pence, or yards, feet, and inches, &c. but each column separately agrees in the result; it is plain, that either of the columns may be separately used; but with different degrees of exactness in some cases.

The middle column having 12 f's to the octave, it is evident that the number of f's in *the regular expression* for any interval, will shew, to which of the 12 finger-keys, or notes of the vulgar half-tone system, the same belongs: thus all intervals less than 23 Σ + f + 2 m may be classed with the unison, or first degree, and considered as temperaments; all between this and 80 Σ + 2 f + 7 m, may be considered of the second degree, or as minor seconds, &c.

In like manner, the third or m column of 53 parts in the octave, are the *Artificial Commas of Mercator*, as is particularly explained in our article Common *Measures* of intervals, and by help of which commas, the calculations of most intervals, except those near to or less than a comma, may be correctly performed. And, in like manner, the first column, separately considered, of a table of regular intervals, constitute Mr *Farey's Artificial Commas*, 612 to the octave: by means of which, the utmost facility, and every requisite degree of accuracy, is given to the calculations of all real or diatonic intervals larger than Σ; (except sometimes confounding R and *fc*, and also Ͼ and φ), mostly in whole numbers; and in the calculations of temperaments, or where decimal or vulgar fractional parts of this artificial comma are used, even the smallest intervals, as well as the largest, are represented by them and decimals, with greater accuracy than it is practical to make experiments, or to apply musical calculations in practice. (*c*)

FARMING. See Agriculture.

FARNHAM, a town of England, in the hundred of Farnham, and the county of Surrey, is situated partly on a hill not far from the north bank of the river Wye. The town consists of one principal street, with some smaller ones branching off to the north and south, and the houses are in general excellent. The principal public buildings and establishments at Farnham, are the castle, the church, and the market house, with a free school, and a good charity school. The castle is situated upon a hill, on the north side of the principal street. It was built by Henry, (brother of King Stephen,) Bishop of Winchester, and has ever since been the summer residence of the Bishop of Winchester. It was greatly injured in the civil war in 1642, but was rebuilt and repaired after the Restoration by Dr Morley, Bishop of Winchester. It is built of brick, covered with stucco, and is embattled; and of a quadrangular form. Some remains of the keep of the ancient castle are contiguous to the edifice. It is called Jay's Tower, which is ascended by 63 stone steps. It contains a kitchen garden on its top, consisting of 48 rods of land. The whole is surrounded with a strong stone wall, at the foot of which is a moat planted with oaks. The church, which was formerly a chapel of ease to Waverley Abbey, is at a little distance to the south of the High Street, and is a large building, apparently built about the end of the 15th or the beginning of the 16th century. It consists of a nave continued to form the chancel, with a north and south aisle. Its numerous windows are adorned with tracery; and the interior contains several handsome monuments, with a painting of the 12 apostles on an altar-piece. The tower, which is very substantial, has a small turret at each cornice; and there is a bracket at the west end, which seems to have supported a niche for an image. Farnham was once celebrated for its cloth manufacture; and the hops cultivated in the vicinity of the town, have always been regarded as the best in England. A great trade in Welsh hose is carried on in the town. The following is the statistical abstract for the town and parish in 1811:

Number of inhabited houses	697
Number of families which occupy them	570
Families employed in agriculture	170
Do. in trade and manufactures	306
Males	1361
Females	1560
Total population	2911

See the *Beauties of England and Wales*, vol xiv. page 241. West Long. 47' 52", North Lat. 51° 13' 7". See Surrey. (*j*)

FARO, the name of a town of Portugal, in the province of Algarvia. It is situated in a level and sandy plain, about a league from the sea, and on the bank of the river Da Quarteira. The town, which is quite open, is regularly built, and has tolerably broad streets, composed of small houses. The houses in that part of the town round the church of San Pedro, have still a Gothic appearance, as this was the only part of the town which escaped, when it was plundered and burnt by the English in 1596. There is a handsome square with some considerable buildings, situated on the side of the river; and one side of the town is defended by a small citadel. Faro is the see of a Bishop, suffragan of Evora, and has a governor, a brigadier, and a corregidor. It contains two parishes, and three monasteries. Small vessels can come up to the town, but large ones are obliged to unload in the road or lower down the river, which, after numerous windings, forms the narrow entrance of the harbour a league and a half to the south-east of the town. The harbour is defended by the fort of San Lourenço de Olhaõ, situated on the east side of the river. Another narrow arm of the river, or properly speaking of the sea, called a *Baretta*, forms an island, on which is the sandy cape of Santa Maria. In all the maps, this island is laid down at too great a distance from the land. The tract between the town and the sea is very marshy, and is covered with marine plants. It is flat and sandy on the opposite side; and at a distance rise the mountains of San Miguel, which are high and steep, but well cultivated towards their base.

The greater part of the trade of Algarvia is carried on at Faro. Wine and fruits, but particularly figs, are exported in great quantities. The figs are thrown down by the country people in a heap, in a building for this purpose. The syrup which flows from them is used in making brandy. They are then spread in the sun in an open situation, and are afterwards pressed into small baskets made of the leaves of the fan palm, each containing 28 pounds. They are chiefly of the white kind, though the red, particularly the Figo do Enchario, and do Bispo, are most esteemed. Oranges and Spanish reeds are also exported from Faro to England. Number of houses 1200; population 5000. West Long. 7° 52', North Lat. 37° 2'. (*j*)

FAROE, the name given to a group of islands in the Northern Ocean, belonging to Denmark.

History.

The early history of these islands, though they were colonized by the same people who rendered that of Iceland so extraordinary, presents nothing in the least degree interesting. They appear to have been resorted to long before Iceland was discovered; and the same cause, the subjugation of the petty states of Norway by Harold the *fair-haired*, led to the colonization of both in the 9th century. Those inhabitants of Norway who did not chase to submit to that victorious monarch, left their native country, and settled in Iceland, Faroe, Zetland, and Orkney. Lucas Debes, in his curious work *Feroa Reserata*, very justly remarks, that had the people of Faroe, who were of the same rank with those who

History.

betook themselves to Iceland, been equally diligent in the cultivation of letters as their western neighbours, we might have had better and more interesting information handed down to us. It is not improbable that, as the Faroese employed themselves in piracy, they were objects of jealousy and attack; and being thus constantly engaged either in molesting their neighbours, or in defending themselves, education and literature would of course be neglected.

The islands were at first the property of various chiefs, whose petty warfare seems to have lasted a long time, until they were finally subdued by the kings of Norway. The Christian religion was introduced in the year 1000 by a native, Sigismund Bresteson, who was employed by king Olave Trygeson. The reformed religion appears to have been established about the middle of the 16th century.

In the last century, a very close connection between various parts of Britain and Faroe subsisted during the American war, and for some time after. They were found to be a most convenient depot for goods intended to be smuggled into this country; and regular establishments were made for carrying on a contraband trade. The frequent intercourse between the people of the two countries, rendered the English language familiar to the Faroese, of whom a considerable number is yet to be met with who speak it with fluency. The war with France, and the destruction of the Dutch and Danish East India trade, put a final stop to smuggling, and reduced the islands to a state of great poverty. In the year 1808, Captain Baugh was sent to Faroe with the Clio sloop of war, and the fort at Thorshavn was destroyed, to prevent its being a protection to privateers. Some time afterwards, a German, assuming the title of Baron Hompesch, who had obtained a letter of marque, landed at Thorshavn, plundered the inhabitants of every thing, and broke into the church where the public chest was deposited. A small crucifix of silver, which stood on the altar, was seized with eagerness, but when it was found to be hollow, and of no great value, it was restored. The British government very properly and humanely refused to sanction these proceedings; and some disturbances having happened in the year 1809, between some British merchants and the Icelanders, an order in council was issued, commanding British subjects to consider the Icelanders, Faroese, and the people of the Danish settlements in Greenland, as stranger friends, and permitting a trade between these places and the ports of London, Leith, and Liverpool, on certain conditions. The money, and the value of all the goods of which Faroe and Iceland had been robbed, were restored.

In 1811, Lieutenant Banks of the Forward gun brig, was dispatched from Leith to make a report on the state of the Faroe islands, representations having been made to government, that the inhabitants were in great distress on account of the scarcity of provisions. Two ships, in consequence of Mr Banks' report, were permitted to carry corn and other articles from Denmark to Faroe, and to take Faroe goods in return, provided they touched at Leith to have their licenses annually renewed. The peace concluded with Denmark in January 1814, and the recent arrangements with Norway and Sweden, will save the inhabitants from the risk of famine; but unless the Danish government becomes a little more liberal, and a little more enlightened, in regard to the management of their distant possessions, the people must continue in a state of miserable dependence, and without the means of improving the little soil capable of cultivation.

Topography.

The Faroe islands lie between 6° 15′ and 7° 43′ Longitude West from Greenwich, and between 61° 20′ and 62° 25′ North Latitude. The group consists of twenty-two islands, of which seventeen are inhabited. Their appearance, whether when approached in fine or in bad weather, is inconceivably grand, especially from the south-east and west. While the sun approaches the western horizon, and the sea is smooth, with a gently undulating motion, nothing can exceed the sublimity of the scenery. The stupendous masses of light and shade, and the varying tints reflected from a thousand fantastic forms, hewn by the hand of nature from piles of rock, many of which soar to the height of 3000 feet, produce an effect beyond description.

The central island of the group, Stromoe, is likewise the most extensive, and contains the highest mountain. This island stretches (as all the others do) from nearly north-west to south-east, being in length 25 geographical miles, and on an average about 5 in breadth. It is deeply indented by bays and creeks, some of which form commodious and safe harbours, particularly that of Westmanshavn, which is fit for the reception of every description of ships. The south-west and west coasts present finely varied and magnificent rock scenery, more especially the west, where, for a distance of about 12 miles, the eye meets continued changes in the forms of the precipices. To enjoy such scenery in perfection, and to give it the fullest effect, one must coast along in a boat at a short distance from the rocks. The curious traveller may, in this manner, obtain the greatest enjoyment. Sometimes he may enter a cavern, and, after exploring it till he almost loses the light, may find himself yet at a distance from the place, where the swell meeting the bottom of the abyss recoils with a tremendous roar. Often, while he is admiring the singular forms of the precipices, the boat passes through a perforation, and he finds them detached from the mountain, and standing like huge walls, towers, or castles, surrounded by the sea. On these the sea birds have their nests, and there the hardy fowler fearlessly robs them. On this remarkable coast, the rocks soar from 1500 to 2000 feet. Each island has its beauties; and there is scarcely a promontory or detached rock, that does not present something combining singularity with magnificence. Of these, the rock called the Witch's Finger, and the little island called Tindholm, the one on the east, and the other on the west side of Vaagoe, are perhaps the most remarkable. The former is detached from the adjoining precipice almost to the bottom. From some points of view, it has the appearance of a grand square tower, surmounted by a lofty spire; and when the light falls in a particular direction, the resemblances of a door and windows are quite distinct. This was observed by the writer of this article at a distance of five miles. When viewed in that position in which it appears detached from the rock, it is not unlike a huge finger pointing upwards. Landt states the height of this peak to be 1200 feet, and we believe that this does not much exceed the truth. The elevation of Tindholm is probably about 600 feet, and its singular appearance is much more striking. On one side, though very steep, it is covered with verdure almost to the summit, which consists of a number of long and slender peaks ranged along the ridge, which terminates on the opposite side a perpendicular face of rock. In crossing the island of Vaagoe towards this rock, its summit is seen in a form bearing a very close similitude to the towers and pinnacles of Westminster Abbey. In some places, there are ranges of columnar rocks; but, in general, they are not in such situations as to render them of much importance in the scenery. The promontory of Niepen in Stromoe, presents a very beautiful range of columns. There are some in Osteroe, which are lofty, but from their situation not very striking. Several very curious columnar rocks are to be seen in Suderoe and Myggenæs.

The highest mountain is that called *Skellingfell*, or *Skielinge Field*, which rises very abruptly, terminating in a small platform. It exceeds 3000 feet in height; but it has not yet been very accurately measured. The frequency of fog, which often suddenly envelopes the adventurous traveller, even in fine weather, renders the ascent of the Faroe mountains a very hazardous undertaking. The height of Slatturtind, in Osteroe, is 2825 feet; and there are several mountains in the same island, which appear equally high.

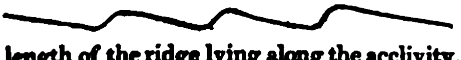
There is nothing in Faroe which can be called a valley; the mountains for the most part meeting at the bottom, and having only a small rivulet as a boundary. There are a few lakes, the largest of which is in the island of Vaagoe, being about three miles long, and one in breadth. Beyond the upper end of the lakes, there is generally a small extent of flat ground.

Rural affairs.

The inhabitants have chosen for their villages such spots as are dry, or may be rendered so easily, and which have the advantage of a commodious landing place for boats; though this last, in a few instances, gives place to the former.

Many of the occupiers of land hold it in property; and others of the crown of Denmark, paying a tax for it of from 20 to 40 skillings for each *mark*. A *mark* is an extent of land which rarely supports more than two cows during the year, though some maintain four. It is generally reckoned to be about 8000 square Danish ells; but the *mark* varies in different places, and is valued at about 600 dollars.

The whole surface of the country is very wet; and, in general, the soil is thin, and for the most part consists of peat. On such a soil, under a climate, not indeed rigorous, but exceedingly moist, and consequently ungenial, from the rays of the sun being so much excluded from the surface, agriculture cannot be supposed to be in a flourishing condition. The inhabitants being regularly supplied from Denmark with barley and rye, and sometimes with pease, the cultivation of grain is carried to a very small extent, while hay for the cattle during winter is an object of the first importance. By repeated working, the land is thrown up into ridges, a section of which exhibits this form,



—the length of the ridge lying along the acclivity. This is undoubtedly the best form that could be devised for carrying off the surface-water with the least damage to the soil. When barley or turnip seeds are to be sown, or potatoes planted, a large dose of manure, made up of dung and ashes, is spread upon the first ridge. The turf is then cut from the next, and laid with the grassy side downwards on the dung. This is chopped with a spade, and a little more soil is laid on, and the seed scattered over it, when it is again stirred with the spade. No grass seeds are sown; and, before a miserable crop of hay can be reaped, the land must lie waste for three years, when a coarse herbage, the greatest part of which consists of sorrel, is collected by nature. It is a fact for which no good reason can be discovered, that the vegetative power of the grain imported from Denmark is previously destroyed by kiln-drying; and thus the poor Faroese are compelled to sow their own shrivelled and unripe corn. The turnips which grow in Faroe are a yellow sort, but small and hard; and the potatoes are diminutive and watery. Such, however, is the industry of the people in some places, that soil is often seen laid on the flat surfaces of large stones, in which potatoes of very good quality are produced.

Rural affairs.

The cattle are very small; and no pains being taken to select the best for breeding from, few are to be met with that are well shaped. They yield but a small quantity of milk; but it is sweet and rich. The sheep vary a little in appearance, and in the quality of their wool. This is owing to a supply having been brought to the country, after a season of unexampled fatality among the native sheep, partly from Iceland, and partly from Zetland. From the wool, excellent strong stockings are manufactured, and likewise close jackets, which are worked, like stockings, on wires, and ornamented with figures done with variously coloured worsted, dyed in the country. To give a yellow colour, the *Anthericum ossifragum*, *Polygonum hidropiper*, *Polygonum persicaria*, and the *Lycopodium complanatum*, are used; for black, the *Geranium sylvaticum*; for red, the *Lichen calcareus* and the *Lichen tartareus*; for brown, *Lichen saxatilis* and *Omphaloides*; and for orange, the *Lichen parietinum*.

The wool is torn from the sheep when the fleece begins to loosen; but frequently that event is not waited for, and the skin of the animals is often cruelly lacerated. The horses are small, and in general not well shaped. The best are to be seen in the island of Suderoe. They are very seldom used, except for carrying home fuel from the mosses; there being no roads and no wheel carriages.

Fishery and provisions.

It might be supposed, that the sea around these islands was a never-failing source of subsistence and profit to the people who inhabit them. Formerly a considerable fishery for cod was carried on; but now it appears, that the only bank in the vicinity (which is about two miles north of Kalsoe) is almost totally destitute of fish. The accounts of this failure, which the writer of this article received, may, however, be somewhat exaggerated. It is indeed true, that fish are not abundant on the coasts; but there appears no inducement to prosecute the fishery with vigour. It seems to be the policy of the Danish government, to keep the natives of their distant possessions in a state of poverty and perpetual dependance, and to encourage merchants from Denmark to provide them with grain and other necessaries, which are exchanged for the woollen jackets and stockings, the manufacture of which is the chief employment both of the men and the women. Of these goods a very large profit is made on the continent. The price of grain, however, is never raised to the Faroese, whatever it may cost in Denmark; and when it is brought to Faroe, it is divided with scrupulous accuracy, and distributed according to the circumstances of the different classes of inhabitants. Barley is the principal article; pease, rye meal, and oats being less commonly used. In the year 1812, 5650 barrels of grain and meal were imported; and this quantity was considered as a sufficient supply. There being 5120 people in all the islands together, each person, supposing the provision to be equally divided, would

Fishery and provisions.

have per diem about half an English pint of barley or meal. But the distribution is not equal; and there are a variety of considerations which render it a complicated and troublesome business. The people of the principal town, Thorshavn, not being farmers, receive a stated annual allowance of one barrel and five-eighths each person; and this is not given to them all at once, but at weekly distributions. The people in the country have an allowance proportional to the stock on their farms, and their success in fishing and fowling. The greater the stock, &c. the smaller is the proportion of corn; as it is supposed that a rich farmer can purchase a larger quantity if he requires it. The sysselmen or sheriffs, and the clergy, send certificates of the cases of their respective districts to the commandant, who makes his calculations, and distributes the corn accordingly. The farmers are divided into four classes, which respectively receive one-fourth, three-eighths, one-half, and three-fourths of a barrel of corn, when there is a full supply. It appears, that the house of Frische & Co. of Copenhagen, have the monopoly of the Faroe trade, on condition that they supply the islands with a sufficient quantity of corn at a fixed moderate price. The government, at the same time, binds itself to remunerate the merchant in the event of his losing. How the accounts are settled seems to be a mystery; but it is probable that, miserable as Faroe is, the monopoly of its trade is not unprofitable. The returns on woollen goods are said to be between 300 and 400 *per cent.* and that on oil to be no less than 1500 *per cent.* Tobacco being in very great request, it is likely that the exchange of this article yields immense profit, as a good jacket has been seen exchanged for a few leaves. But it is needless to take up more room with conjectures respecting what it seems to be the interest of the merchants to keep carefully concealed. It ought to be stated, however, that the writer of this article was informed by the commandant, that since the year 1808 there has been a loss on the Faroe trade of half a million of dollars.

At the time when the fishery flourished, a ship of considerable size used to be loaded once a year at the village of Eyde in Osteroe, and cargoes were made up at several other places. At times, the *caing* whale, as it is called in Orkney, (and which is now supposed to be a new species,) comes to Faroe in vast shoals. When they appear, signal fires are lighted on the hills, and the joyful intelligence is soon spread to every corner. In a few hours a numerous fleet of boats is assembled; for, whatever may have been their employment, it is instantly forsaken to pursue these whales. Sometimes shoals of a thousand and upwards are seen sporting about the islands. Being surrounded, they are driven into some convenient creek, where there is a sandy beach, such as that of *Midvaag* in *Vaagoe.* The shoal carries forward a body of water sufficient to float them into the creek, and when they take ground the work of death begins. The animals are destroyed by means of long spears. Their oil is the chief object with the people, and it is an article in great demand in Denmark. The flesh is cut up, and hung to dry in wooden buildings, constructed of spars so as to admit plenty of air. In its dried state, without any other preparation, it is reckoned a delicacy; but the odour forbids a stranger to approach within several yards of this dainty.

When these welcome visitors have been slain and secured, they are valued by the sysselman and his assistants. The tythe is first set apart; but the largest animal is given to the boat's crew who first discovered the shoal, the head being the property of the man who first descried it. Another is set aside to be distributed among those whose boats may have been damaged in the attack. The provost, or dean of the clergy, has one allotted to him; and one is given to the poor. The rest are divided into two equal portions, one of which belongs to the proprietors of the place where the shoal came on shore, and the other to those who assisted in driving them.

There can be little doubt that the herring fishery might be prosecuted about Faroe with success; but it has never been attended to.

Bird-catching.

The only other source of subsistence which remains to be mentioned, is the great number of sea birds which nestle in the rocks. Of these, the puffin (*Alca arctica*) is the most numerous, and the most sought after. But various other kinds are taken. The eider duck, which in some other countries is so carefully protected for its down, is here often shot for food. The bird-catchers are exceedingly adventurous; and as this is the first opportunity we have had of describing this hazardous occupation of the inhabitants of many northern countries, an account of it may entertain our readers.

The fowlers are provided with long poles, to the ends of which are fastened small poke nets. With this instrument they generally display great dexterity in casting it over the birds, which invariably make towards the water when they are disturbed. It is this anxiety of the birds to seek the element in which their security is to be found, which gives certainty to the exertions of the fowler. The birds push their heads through the meshes of the net, which being dexterously inverted, keeps them suspended by the neck.

When a fowling expedition is undertaken, two men fasten themselves to a rope, so that there may be eight or ten fathoms of it between them. One assists the other to ascend the rock by means of a pole, at the end of which is a hook, which is fastened to the band of the climber's breeches, or to a rope tied round his waist, and thus he is pushed up: But the most common method is for the climber to seat himself on a board fastened to the end of the pole. They often ascend frightful cliffs without any assistance. When the first has got to a place where he has some footing, he helps the other up by means of the rope to which they are both fastened. When they have gained the elevation where the birds are pretty numerous, they assist each other from cliff to cliff. It sometimes happens that one of them falls and pulls the other after him, when both are precipitated into the sea, or dashed to pieces on the projecting rocks. When the rocks are so high and smooth as to render it impossible for the fowlers to ascend, they are let down by means of a strong rope from above. To prevent the rope being cut, a piece of wood is placed at the verge of the precipice. By means of a small line, the fowler makes signals to those above, and they let him down or pull him up accordingly. When he reaches a shelf of the rock where the birds have their nests, he unties himself, and proceeds to take them. Sometimes he places himself on a projecting rock, and, using his net with great adroitness, he catches the birds as they fly past him; and this they call *heining.* This mode of catching birds is even practised while the fowlers are suspended. When a projection of the rock is between the fowler and the place where the birds are, he swings himself from the rock so far that he turns round the projection. In this, great address and courage are requisite, as well as in swinging under a projection into a cavern. When he cannot, with the help of his pole, swing far enough, he lets down a line to people stationed in a boat below, who swing him, by means of it, as far as is necessary to enable him to gain a safe place to stand upon. Besides being exposed to the risk of the rope breaking, the fowler is frequently in danger of being crushed by pieces of the rock falling down upon him.—Such are the hazardous means to which these poor people resort for procuring food.

Seals were formerly taken in the caverns which abound on the coasts, in great numbers; but they are either not so numerous now, or there is less inducement for their capture.

The town.

Thorshavn, the principal place in the country, is situate on the east side of Stromoe; the houses being built on a narrow tongue of land jutting out into the sea. Two small creeks are thus formed, in either of which vessels may be safely moored, large iron rings being fixed in the rocks, on both sides, for that purpose. The houses are constructed of wood, and crowded together without any regularity. The roofs are covered first with birch bark, brought from Norway, over which turf is laid. The green colour of the tops of the houses assimilating with that of the soil around the town, renders the place almost invisible from the sea, at a very short distance. The house of the commandant is the best furnished, but that of the *landfoged*, (who is here *high sheriff* as well as treasurer,) is the most spacious. Though the exterior of the buildings does not promise much, yet the rooms are generally neat and clean. The church is a large wooden edifice, covered with slate, and painted white. It has a small steeple, and altogether its appearance is very respectable. There are many large storehouses in different parts of the town, several of which are now locked up, on account of the almost total annihilation of trade. The prison is a small wretched building of stone, in which those convicted of crimes, such as sheep-stealing, are confined for several years. They are brought out occasionally, however, to work when any thing particular is required to be done. At the mouth of the harbour are the remains of a small but strong fort, the guns of which were destroyed in the year 1808.

Country houses, character, and manners of the people.

The houses of the farmers and of the clergy are in general good. In all of them the traveller will find himself hospitably received, and accommodated with an apartment as neat and clean as he could desire, though not elegant. The hospitality of the poor Faroese is really remarkable; the readiness with which they produce their little stores to share them with a stranger; their alacrity in complying with his wishes, and their anxiety to anticipate them, are, to a mind not altogether devoid of feeling, truly affecting. In their deportment they are exceedingly polite and respectful; and the strict honesty which was experienced by the writer in numerous instances, during his intercourse with the natives, raised their moral character very high in his estimation. To religious duties they pay the most regular attention. Almost every village has a church; and when the priest is engaged elsewhere, or detained by the weather, the clerk reads the service. On the Sunday evenings, and on holidays, the people give themselves up to merriment. In fine weather, groups of them are seen in the fields, formed into circles, moving round in slow cadence, (which they call dancing,) to a song in which sometimes 15 or 20 voices join. The subject of the song is usually some atchievement of their forefathers, or the history of faithful lovers; and the airs are wild and not without harmony; they are, on such occasions, dressed in their gayest clothes, and they often continue for several hours, singing and dancing with scarcely any intermission.

Superstitions.

Debes relates several superstitions which were prevalent in his time, but which are now exploded. Still, however, some remnants of credulity may be traced, and some persons are to be found, who believe that they have seen the phantoms of people at a distance, at the moment they expired, and thus had notice of their death. In this respect the Faroese are not more superstitious than the common people in many districts of our own country.

Manner living.

Barley bread is that which is commonly used in Faroe, rye being imported in very small quantities; this, with milk or fat, constitute breakfast. In the autumn, when the lambs are slaughtered for drying, the blood is boiled with the milk. Dinner consists of fish and water gruel, improved by being boiled with bones or fat. Soup is sometimes made with fresh or dried meat, and turnip leaves. Dried lamb is eaten raw with tallow, and dried whale flesh is esteemed a delicacy. On holidays a large pot is placed on the fire, and a quantity of sea-birds boiled for supper. The quantity of fat which these people devour, and the state in which the rest of their animal food is taken into the stomach, might be deemed unwholesome; yet diseases are not frequent, the appearance of the inhabitants being every where robust and healthy; the children, however, are generally puny looking, their legs being particularly slim. Fevers and rheumatism are the most common diseases, and Landt asserts that the stone is more frequent in Faroe than in other countries. The small-pox seldom visits Faroe; and, at the present time, there is not a native who has had the disease, except one who caught the infection in Denmark. Elephantiasis was formerly a prevalent disorder, and an hospital was established near Thorshavn for the reception of lepers. The remedies used by the natives are simple, and, as might be expected, harmless and ineffectual, such as soaking the parts affected in water, into which a piece of old gold or silver coin, or some ornament, is put, and decoctions of various plants applied externally. The only surgical operation performed is the extirpation of the uvula, when, from relaxation, it lengthens and obstructs the passage to the stomach and lungs. There is a surgeon established at Thorshavn, with a salary from the Danish government; but his skill is not much improved by practice.

Diseases.

Dress.

The dress of the men of Faroe consists entirely of woollen stuffs, manufactured in the country. Their jackets, which are worn in their ordinary occupations, are knitted, and ornamented with figures in coloured worsted. In full dress, they wear a long frock of a dark brown or black colour, and breeches of the same. Their shoes are made of sheep skin, slightly tanned with the root of *tormentilla*. They are formed by cutting a piece of skin of a proper length and breadth, and puckering, very neatly, the parts for the toes and heel: the fastening is a white woollen thong, knitted for the purpose, and tied round the legs. The dress cap is formed like a bishop's mitre; on ordinary occasions they wear woollen caps, and sometimes caps of skin, with the hairy part outermost. The men never cut their hair; and to appearance seldom comb or wash it.

The women wear their hair combed backwards from the forehead, and have white linen caps with a broad stiff border of coarse lace, rising perpendicularly. The cap is fastened by a coloured silk or cotton kerchief tied under the chin, with a piece of ribbon floating behind. The rest of the dress much resembles that of the peasantry in most parts of Scotland, the materials being coarser. They wear aprons, and cotton kerchiefs over the shoulders and bosom. The greater the number, and the more gaudy the colours, the more superb is a dress esteemed. A bride on her wedding-day is very gaudily ornamented: a red or blue jacket, with long skirts puckered up into folds, having long sleeves, with velvet cuffs and lace ruffles, constitutes the principal part of the dress. The kerchief worn round the neck is, on this occasion, white, with a border of lace. On the bosom is fastened a large pin or broach, having a broad silver plate in the shape of a lozenge, to which are appended a great number of small flat pieces of silver, which, on the wearer moving, make a jingling noise. The head dress is much ornamented with ribbands, and gold and silver ornaments.

The language of the Faroese, from the circumstance of its never having been written since the settlement of the people in the islands, has become very different from what it was originally. It may still be traced, however, to its parent the Scandinavian, or, as it may now be called, the Icelandic. Almost all the natives can speak the Danish language, in which divine service is performed.

Education.

There are now no schools in Faroe; but parents do not neglect to teach their children to read, and sometimes to write. The people are fond of reading; and several of them, with whom the writer of this article conversed, shewed great eagerness for information of every kind. One of them to whom he explained the use of the barometer, which seemed to excite great curiosity, was exceedingly delighted, and appeared to comprehend perfectly its use in measuring the heights of mountains. He remarked that he was now an old man, but that he could never be too old to learn. The name of this person is *Hans Alaik*. He conducted Sir John Stanley through some of the islands upwards of 20 years ago, and was the interpreter and guide of the writer of this article.

Statistical Table 1812.

Names of the Islands.	No. of Inhabitants.	Men Confirmed.	Women Confirmed.	Boys not Confirmed.	Girls not Confirmed.	Milch Cows.	Calves, Heifers, Oxen and Bulls.	Stock of Sheep.	Sheep and Lambs Slaughtered.	Boats of eight Oars.	Boats of six Oars.	Boats of four Oars.
Northern Islands	710	232	238	126	114	271	76	5192	3461	21	7	46
Osteröe . . .	1256	412	421	208	215	503	125	7717	5145	36	12	83
Stromöe and Nalsoe	1075	378	351	167	179	437	109	8805	5670	38	6	75
Town of Thorshavn	518	157	209	74	78	28	6	204	136	7	2	22
Vaagöe . . .	496	174	182	75	65	210	52	5902	3935	13	7	25
Sandöe . . .	435	163	157	61	54	245	61	4309	2939	13	6	26
Suderöe . . .	719	250	257	111	101	298	77	3178	2152	14	15	50
	5209	1766	1815	822	806	1992	506	35,307	23,438	142	55	327

The census mentioned by Landt was taken in 1782, and the number then was 4409, which gives an increase in 1812 of 800.

Where mechanical labour is so little required, separate trades are not to be looked for. Every one can provide himself with clothing, and can act as a carpenter. Boat-building is carried on chiefly in Nalsoe. Both men and women employ themselves in spinning wool and in knitting. The Faroese loom is a very rude machine; but the cloth which it forms is of a very good texture. The loom consists of two upright posts set up against the wall, and having two projections to support the beam, to which the upper ends of the warp are fixed, the lower being attached to stones, which keep the threads stretched tight. The woof is passed through the warp by the hand, and forced up against the warp by means of a small piece of wood; after which it is pushed firm by means of a smooth whale rib. This operation is exceedingly slow, as at each movement the threads must be unwound from the stones. In Thorshavn there are a few looms of improved construction.

The trade is carried on by the Danish government through the intervention of a respectable house in Copenhagen. The exports are stockings and jackets, train oil, feathers, and skins. Tallow, fish, and butter, are now so scanty, as scarcely to supply the wants of the natives. The imports are, grain, fishing materials, tobacco, a little sugar and coffee, timber, tar, nails, lead, gunpowder and some other articles, all in very small quantities. Stockings and jackets are at present the chief articles of export.

Revenue.

The revenue is collected out of the produce of the country. For every sheep of the permanent or estimated stock of each farm, a lamb's skin is paid; and, for every sixty sheep killed, 36 lbs. of tallow, and thirty skins. The proportion of wool paid as tax, is sold at a fixed price to the people of Thorshavn. Formerly, the whole revenue usually amounted to between 3000 and 4000 rixdollars.

Religious and civil government.

The religious establishment of Faroe is now under the superintendance of a provost. There are seven parishes, and 39 places of worship, so that the duty of the clergy is exceedingly laborious. The stipends are inconsiderable, and are chiefly paid in kind. To the glebes a permanent stock of sheep, and sometimes a few cows, is attached. Glebes are also provided for the widows of the clergy.

The civil establishment is under the direction of a military officer, commanding 30 men, who maintain the form of mounting guard, and keeping a look out for ships. Under the commandant are, the landfoged or treasurer, and the sysselmen, or governors of districts.

Natural history.

The natural history of these islands, if we except the department of mineralogy, presents nothing that is uncommon to other countries in the same latitude. On the contrary, they are very deficient both in their botanical and zoological productions; and to enumerate what they do possess would be quite uninteresting. The islands are formed almost exclusively of trap; beds of wood coal, and pitch coal, forming the only exception. The most common characters of the trap are amygdaloidal and porphyritic; greenstone occurring chiefly in the columnar form, and basalt in veins assuming commonly the same form. The amygdaloids contain every known variety of zeolite in the greatest perfection; and in the island of Nalsoe, native crystallized copper occurs in the same kind of rock. A great variety of beautiful chalcedonies, common and semi-opal, are to be found in great abundance; and the island of Suderoe furnishes elegant jaspers. There are some very remarkable geological facts to be seen in different parts of the islands; but as these are closely connected with some, equally curious and important, which were discovered in Iceland, we will defer giving a particular account of them, till we come to that article.* See Lucas Debes *Feroa Reserata*, 1670. *Description of the Faroe Islands*, by the Rev. G. Landt, translated from the Danish, London, 1810. *Transactions of the Royal Society of Edinburgh*, vol. vii. 1814.

FARQUHAR, George, an eminent English comic writer, was born in the year 1678. His father was a respectable clergyman in the north of Ireland, who, having a numerous family, could not bestow any fortune upon him, but resolved to give him such an education, as might enable him to prosecute some genteel profession.

Farquhar discovered an early taste for literary pursuits, and is said to have written verses when only ten years of age. In 1694, he repaired to Trinity College, Dublin, where he made such progress in his studies, as procured for him considerable reputation. It would appear, however, that his prudence was not equal to his literary attainments; for he was expelled the college, in consequence of having adventured profane wit upon a sacred theme, given to him, as an exercise, by his tutor.

At an early period of life, he turned his attention to the stage, intending to follow the profession of an actor; in which career he was not very eminently successful. He possessed an engaging person, and genteel manners, but his voice was weak, and he had a natural timidity in public, which he could never overcome, and which was extremely prejudicial to his appearance on the stage. He resolved, however, to continue the exercise of this profession, until some better prospect should open; but this resolution he is said to have abandoned, in consequence of the following accident. While performing the part of *Guyomar*, in the *Indian Emperor*, who is supposed to kill Vasquez, one of the Spanish generals, having forgotten to exchange his sword for a foil, in the engagement he wounded the person who represented Vasquez, though not dangerously; and this unfortunate incident had the effect of preventing him from again appearing on the stage as an actor.

Some time after this, the Earl of Orrery gave him a lieutenancy in his regiment, then in Ireland; and Farquhar is said to have conducted himself well as a soldier. He was honoured and beloved by his comrades, and proved himself to be a man of courage and conduct.

In the year 1704, he married a lady, who was so violently in love with him, that, despairing to win him by her own personal attractions, she contrived a deep scheme of imposition, by which she allured him into wedlock, under the impression that he had married a woman of immense fortune. But it redounds highly to the honour of Farquhar, that, after he had discovered the deceit which had been practised upon him, he entirely forgave the lady her fault, in consideration of her love and accomplishments; and always treated her with kindness, although this unfortunate marriage is supposed to have conduced, with other circumstances, to shorten his days: for his fortune was too slender to support a family; and the maintenance of his wife and children reduced him to the utmost poverty, while his anxiety for their welfare preyed upon his spirits, and injured his health. He died at the age of 29, four years after his unhappy marriage, and is said to have met his fate with fortitude and cheerfulness. He left two daughters, whom, in the following letter, written a few days before his decease, he recommended to the protection of Wilkes, the celebrated actor, with whom he had contracted a sincere and intimate friendship when upon the stage, and for whom he wrote the famous character of Sir Harry Wildair, in the Constant Couple.

"Dear Bob,

"I have not any thing to leave you to perpetuate my memory, except two helpless girls; look upon them sometimes, and think of him that was, to the last moment of his life, thine,

George Farquhar."

Wilkes humanely complied with the dying request of his friend, and assisted in providing for the children. Their mother died in great indigence.

Farquhar was eminently successful as a dramatic writer. During the vicissitudes of a chequered life, as a man of fashion, an actor, an officer in the army, an author, a lover, and a husband, his experience had supplied him with incidents, and his observation and reflection with a knowledge of human nature. His subjects are generally well chosen, his characters well sustained, his style pure and lively, his dialogue easy and spirited. But his humour is not remarkable for delicacy; and his plays have an obvious tendency to encourage licentiousness of manners, and a disregard of moral principle.

He wrote seven comedies, of which the most esteemed are, *The Constant Couple*, *The Inconstant*, *The Recruiting Officer*, and *The Beaux Stratagem*, which are still occasionally acted, and preserve their popularity on the stage. (z)

FARS, or Farsistan, is a province of the kingdom of Persia, bounded on the north by Irak, on the east by Kerman and Laristan, on the west by Kuzistan, and on the south by the Sea of Oman. It is divided into two climates, the warm and the cold, which are designated by the names of Germaseer and Sirhud. The warm climate extends from the sea to the latitude of Kazeroon, and then runs parallel with the Gulf from the banks of the Tab to the confines of Laristan. When the periodical rains are abundant, the sandy plain at the foot of the mountain produces a considerable quantity of dry grain; but when the rains are less abundant, a famine generally happens. This sandy plain, which is called Dushtistan, is divided into the districts of Leerawee and Hiadoust, which are separated from each other by the projecting mountain called Kopi Bung.

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* The Editor has been indebted for this interesting account of the Faroe Isles to Sir George Mackenzie, Bart. who visited them in company with Thomas Allan, Esq. in the summer of 1812.

These districts, which contain only a few wretched mud villages, are very badly cultivated. The Cold Region stretches from the parallel of Kazeroon to that of Yezdekhast, on the borders of Irak. It comprehends most of the mountainous part of Fars. The mountain vallies are generally 8 or 10 miles broad, and from 15 to 100 long. They afford abundance of pasturage, and are commonly fertile, though ill cultivated. The plains of Sheeraz, Kazeroon, and Merdesht, however, are in pretty good cultivation; but, towards the north and west, they are almost unpeopled. Mr Kinneir travelled, in 1809, above 60 miles between Behaban and Sheeraz, through the most charming wooded vallies, without seeing the face of a human being. An ancient tribe which formerly inhabited them, had been almost extirpated by the orders of the prince; and the few which had escaped to the summits of the lofty mountains, subsisted upon a wretched kind of bread made from acorns, and upon the pillage of travellers.

The eastern part of the province towards Darabgherd and Fesa is more open. The soil is more sandy, and the plains more extensive.

The range of mountains seen from the coast is not a separate range, but a branch of Mount Zagros, which stretches in a continued succession of ridges from the borders of the Persian Gulf to the Caspian Sea and Mount Caucasus.

The hills in this province towards Bushire, are about 24 miles from the sea. The plain becomes contracted towards Bunder Reig; and to the west of the village of Gunava, a low ridge suddenly projects to the south, and terminates at the sea shore in the projecting point of Kohi Bung, which separates the districts of Leerawee and Hiadouat. This point is not high, but is about 7 or 8 miles broad, and beyond it lies the plain of Leerawee. The mountains are here again 20 miles distant from the sea, and for 18 or 19 miles they preserve this distance, but afterwards approach the south, and assume a circular form near Bunder Deelum. On turning the southern point of this low and advanced branch, which is called Zeitoon, from a small town near Behaban, they again retire to the north, and at the port of the Masboor they are 30 miles from the sea. Their most southern extremity at Shuster, crosses the 32d degree of North Latitude, in the 49th degree of East Longitude.

Fars. Rivers.

The principal rivers, are the Tab, the *Arosis* of the ancients; the Jerahi, the ancient *Pasitigris*; the Bund Emeer, and several others, whose modern names are not mentioned. The Tab, which is the largest, is formed by the union of two streams near Zeitoon, one of which rises at the foot of the high hill of Kamarah, and the other near that of Ardicoone, about 45 miles north-west of Sheeraz. Mr Kinneir considers this latter branch as the river mentioned by Arrian in the march of Alexander. The Tab separates Fars from Kuzistan, and passes through the town of Endian, where it is 80 yards wide (in Feb.) and navigable for boats of 20 tons burthen. There is a ford about 9 miles above the town; and the Tab discharges itself into the sea about 16 miles below Endian. The water of this river is perfectly sweet when it passes Zeitoon; but in running over the hills towards Endian, it becomes so brackish as hardly to be fit for use. This is also the case with all the other rivers in Fars, which empty themselves into the Persian Gulf.

The river Jerahi, which is next in size to the Tab, rises in the mountains immediately behind Behaban, and after flowing within a few miles of that city, it passes through the vale of Ram Hormus to old Derak, in the territory of the Chab Sheikh, where the Arabians have erected a dam, for the purpose of irrigating the fields, leaving two chief branches, one of which passes on the outside and the other through Dorak. The marshes in the neighbourhood of this town are occasioned by the lesser branches. One of the principal branches enters the Karoon above Sabla, and the other empties itself into the sea at Goban. In passing through the vale of Ram Hormuz the Jerahi receives a rapid river which flows from the mountains about six miles east of the town of Ram Hormuz. This tributary stream contains a great body of water, and is not fordable after the melting of the snows. It is the river alluded to in the marches of Timour. The river Bund Emeer, called by some of the ancients Cyrus, and by the Greek historians Araxes, flows through the delightful valley of Merdesht, adorned with the ruins of Persepolis, and in the rich districts of Kurjan it is subdivided into numerous streams for irrigating the fields. The remaining part of the river is joined by Shamier, a small stream which rises in a hot fountain, three miles from Gasian, a town about 90 miles from Sheeraz, and afterwards passes the villages of Kumu and Syvund. The united streams then discharge themselves into the lake Baktegan.

In travelling from Bushire to Endian, Mr Kinneir passed other four rivers. The first of these rises among the mountains behind the old city of Shapour, and after running through this city, and watering the villages of Kesht and Dalkee, it enters the Gulf a little to the south of Rohilla. Mr Kinneir supposes it to be the ancient *Heratenis*. At Rohilla it is 60 yards broad and six feet deep. The second river, which he supposes to be the *Granis* of Arrian, is only seven miles to the north-west of this. It discharges itself into the sea half way between Rohilla and Bunder Reig; but it is neither so wide nor so deep as the former. The third, which is the *Roganis* of Arrian, runs with a south-west course from the mountains, and throws itself into the sea three miles north-east of Gunuva. It is almost equal in breadth to that of Rohilla. At high water it is impassable, but it is only three feet deep during the ebb. The last and the smallest river, which is probably the *Brizana* of Arrian, flows between Hissar and Bunder Deelum. After a wandering course from the hills of Zeitoon, it discharges itself into the Gulf, eight miles south-east of Bunder Deelum.

Lakes.

The salt lake of Baktegan is about 75 English miles in circumference, and is situated about 10 miles south-east of Sheeras. In summer, when it is nearly dry, the people on its banks collect the salt, which encrusts the bottom. This salt is generally used throughout the province, and is reckoned very fine.

Towns.

The principal towns in Fars are Sheeras the capital, Kazeroon about 70 miles nearly west of Sheeras, Shapour, Bushire, Bunder Reig a sea-port with about 300 or 400 inhabitants, Bunder Deelum another seaport having about 700 inhabitants, Zeitoon with a population of about 2000, Behaban, the capital of the mountainous district of Khogiloea, having walls about three miles in circumference, and nearly 10,000 inhabitants, Fallayoon, Selbistan with 4000 inhabitants, Niris, Fesa, Darabjerd with 15,000 or 20,000 inhabitants, and Ursinjan. For more complete information respecting these towns, see Kinneir's *Geographical Memoir of the Persian Empire*, page 54—81, to which we are indebted for all the information contained in this article. (w)

FASCINATION is the name given to an influence which certain animals are supposed to possess over other animals, which serve them for food. This faculty has been ascribed to toads, hawks, cats, owls, tigers, and various other animals, but particularly to the rattlesnake and other American serpents. It is supposed by some naturalists, as Kalm, that the small birds, squirrels, &c. which have been seen to fall from the branches of trees into the mouth of the rattlesnake, must have been previously bitten by the snake; and being thus debilitated, were unable either to escape or to remain upon the tree. Others, as La Cepede, suppose that the rattlesnake produces the effect by a stupifying vapour emitted from its body; while others, as Linnæus and Blumenbach, ascribe the effect solely to the terror inspired by the rattle which is supposed to reside in the tail of this animal. Dr Benjamin Smith Barton of Philadelphia, has drawn up two very interesting memoirs, the object of which is to prove that there is no solid foundation for the opinion that serpents are endued with the faculty of fascinating and charming other animals, and we think that he has succeeded, at least, in rendering this opinion very doubtful, if not in completely overturning it. Such of our readers as wish to prosecute the subject, are referred to the following works, where they will find ample information on the subject.

See Pliny, *Hist. Nat.* lib. viii. cap. 14. Linnæus *Systema Naturæ*, art. *Crotalus Horridus*. Professor Peter Kalm, *Travels into North America*, vol. i. p. 317, 318; vol. ii. p. 207, 208, 209, 210, Eng. Transl. London, 1770—1. Kalm, *Memoirs of the Swedish Academy of Sciences for* 1753. Mather, *Phil. Trans.* No. 339. Hans Sloane, *Phil. Trans.* 1734, vol. xxxviii. No. 433. p. 321. Dudley, *Phil. Trans.* 1723, vol. xxxii. No. 376. p. 292. La Cepede, *Histoire Naturelle des Serpens*, p. 409—411, Paris, 1789. Pennant's *Arctic Zoology*, vol. ii. p. 338, Lond. 1792. *Monthly Review*, vol. ii. App. p. 511. Blumenbach, *Handbuch der Naturgeschichte*, p. 253. Gotting. 1791. Benjamin Smith Barton, *American Transactions*, vol. iv. This paper was published separately under the title of *A Memoir concerning the Fascinating Faculty which has been ascribed to the Rattlesnake, and other American Serpents*, Philadelphia, 1798. Barton's *Supplement* to the above *Memoir*, Philadelphia, 1801. The preceding papers are published also in *Nicholson's Journal*, vol. vii. p. 270; vol. viii. p. 58, 100; vol. xiii. p. 300. Blumenbach's *Reply* to Dr Smith Barton, was published in *Voigts Magazin fur der neuesten zustand der Naturkunde*, Part II. 1798, and in Tilloch's *Philosophical Magazine*, vol. ii. p. 251. See also Ironside in the *Phil. Mag.* vol. xiv. p. 319; *Gentleman's Magazine*, 1765, p. 511; Toplis, *Phil. Magazine*, vol. xix. p. 379; and Michaelis, *Gottingen Magazine*, January 1785. (j)

FASTING, the partial or total abstinence of mankind and animals from the ordinary and requisite supply of aliment, by which is to be understood that quantity which is adapted to preserve them in a healthy and vigorous condition.

We have already given a few examples under ABSTINENCE, of the faculty of living creatures to resist destruction, while exposed to absolute privation of sustenance; and we shall now take a brief view of the consequences of diminishing the usual subsistence of mankind. It is a prevalent opinion, that the sudden reduction of food will immediately prove destructive, especially if to a great extent; and that death will ensue from total privation, even for the shortest term beyond the interval of gratifying our accustomed necessities. But nothing can be more erroneous; for the reverse is satisfactorily established by well-authenticated instances.

Those animated tribes whose subsistence is derived from the uncertain capture of prey, and in this number man must be ranked in his original state, are in general capable of resisting the impressions of hunger for a considerable period. Sleep follows the labours of the chase, and digestion is not conducted with rapidity. Removed from that original state, however, custom usurps the place of nature; and, on looking to the enormous quantities of food consumed by those around us, we should be apt to conclude, that not less than several pounds daily are required for the preservation of health and vigour. Probably there is no race of mankind on the known globe, that practises such an indulgence of appetite as a large proportion of the population of these kingdoms, nor by whom any abridgment would be more sensibly felt; and it accordingly appears, that in warfare, on occurrence of such occasions, the same energies decline, which, opposed to the combatants of other nations, have previously proved successful.

In some uncivilized countries, the supplies of food are scanty and precarious. After enjoying one meal, a long interval may elapse before obtaining another; yet the inhabitants do not diminish. On the Continent of Europe, the meals of the people for the most part are few and sparing; and the inhabitants of the East are almost universally abstemious: a cake of meal, and camel's milk, are the chief subsistence of the Arabians: millions of Indians subsist on rice alone, with water for their only beverage. Nay, if we look into the state of the poorer classes in some parts of the British dominions, we shall find many families subsisting on nothing but potatoes, with scarcely the addition of milk.

But there are countries absolutely sterile by nature, though inhabited by men; others have not yet been reclaimed by agricultural operations, or, if they have, the uncertainty of the climate frequently disappoints the labours of the husbandman; and in this way does the first gradation of fasting arise. The vast continent of New Holland, except for few and distant patches, exhibits an universal aspect of sterility. The vegetable kingdom scarce offers any substance for consumption; there is hardly a species of fruit exceeding the size of a cherry; nutritious roots are rarely discovered; and, in so wide and open a territory, the animal tribes can seldom be obtained for sustenance. The incessant pursuit of those of larger size, as the cassowary and kangaroo, has rendered them shy, while it diminishes their numbers. Fishing is a precarious resource, both from the imperfect implements of the savages, from the storms which constantly assail their coasts, and more especially from the migration of the fishes themselves. The lank visages and emaciated bodies of the natives of the Andaman islands, indicate how sparingly the cravings of nature are satisfied. They live in an abject and degraded state; and, like brutes, their whole time is occupied in obtaining a supply of food. Hitherto no attempts have been made by them to cultivate the lands upon which they dwell; and their whole subsistence is derived from what they can collect or kill. Though their country be less inhospitable than that of the New Hollanders, and their vegetable diet consist of the produce of their woods, little is found there which is palatable to Europeans; and, as they have no vessel which can withstand the action of fire, they are unable to reap much advantage from such esculent herbs as may be contained in them. Their principal subsistence depends on collecting fish from the reefs at the recess of the tide; and the greatest part of the drudgery of doing so, falls on the women, while the men occupy themselves with hunting in the forests.

Independent of natural sterility, there are countries which, after it has been conquered by the industry of mankind, are occasionally visited by famine. In Norway and Lapland, during times of scarcity from unexpected failure of the crops, the inhabitants grind down the bark of trees, which, with the addition of a little meal for a relish, is baked into cakes; and these are represented not to be unpalatable, while they are sufficient for the preservation of life. Famine more terrible is experienced in populous countries, such as occurred a few years ago in Bengal, when many thousands perished; and such as are of frequent recurrence in the great empire of China, where they seem to threaten the very extirpation of the people.

This calamity, no doubt, affords too many examples of the sufferings of abstinence; but those are principally recorded which have arisen from shipwreck, and similar accidents, from peculiar mental affections, or from the body being in a morbid state, or from the two latter combined. Neither is it to be omitted, that voluntary fasting, in observance of religious ceremonies, has frequently been carried to a great extent. Thus the Mahometans, during one of their fasts, are scarcely sensible of nconvenience in fasting 40 days, from sunrise to sunset. In sacred writ it is recorded, that Esther, the queen of Ahasuerus, when apprehensive of a public calamity, said, "Go and gather together all the Jews that are present in Shushan, and fast ye for me: and neither eat nor drink 3 days, night or day. I also, and my maidens, will fast likewise; and so will I go in unto the king, which is not according to the law: and if I perish, I perish. So Mordecai went his way, and did according as Esther ad commanded him." To descend to modern times, owever, Dr Percival of Manchester relates, that he was informed by a young Genevese physician who had tudied at Montpelier, that he then fasted three days nd four nights, without any other refreshment than a int of water daily. But during this probation, though is person did not süffer, he was affected with mental mbecility; a general consequence of thus exhausting he powers of nature. In a melancholy and well-authenticated instance of shipwreck, which occurred in he year 1795, 72 individuals were compelled to take helter in the shrouds of the vessel, while the hull was overed by the sea, where all survived during five days, ithout a morsel of food; but it appears that they were nabled to catch a few drops of rain as it fell, and some f them were drenched with the spray. A term of abstinence still longer, is equally authenticated in the case f Thomas Travers, who, on Saturday the 4th of December 1784, entered a coal pit 270 feet deep, the sides f which immediately fell in. The quantity of earth as so great, that six days were occupied in removing ; and no one could at first venture to penetrate the t, on account of the foul air which was evidently present. Some miners, bolder than their companions, ade a new attempt on Friday, and, guided by the aces of his work, found the unfortunate man lying n his face in a cavity. He could raise his head, but his hands and feet were cold, and pulsation almost extinct. Immediate relief was afforded; but next morning he became indifferent about food, and, having announced his own dissolution, expired in a few minutes, on Sunday afternoon, after fasting seven days. This example illustrates the opinion of Hippocrates, though it is not corroborated by others, namely, that fasting less than seven days is not invariably fatal, but after that period, notwithstanding individuals may survive and take food, their previous abstinence will occasion death. It is to be observed, that here was an instance of absolute privation. In the year 1768, Captain Kennedy was shipwrecked, with 12 companions, in the West Indies. They preserved a small quantity of provisions, which were totally consumed in seven days, amidst extraordinary distresses. During eight succeeding days, though in absolute want, both of meat and drink, and exposed in an open boat, the whole survived; but, after obtaining relief, some of the people perished. In this case they were evidently supported by being frequently drenched with sea-water. Sir William Hamilton, in an account of a dreadful earthquake which devastated Sicily and Calabria in the year 1783, relates that he saw two girls who were miraculously preserved in the ruins of a house. One had survived eleven entire days, and the other six, totally deprived of food.

It must not escape observation, that the difference between absolute privation of food, and a supply of any portion of it, is incommensurable. The same may almost be said of water; for it materially contributes to preserve life: and hence the difficulties of ascertaining what is truly protracted fasting. The Negro couriers, who traverse the deserts on the western coast of Africa, perform long and fatiguing journeys on about four ounces of food daily. It is said that, in common situations, both they and the Moors are frequently seen to subsist eight days on three ounces of gum daily, without sensible diminution of health or vigour; and some maintain, that they can fast three days without any inconvenience. The whole store of a courier at his outset, consists only of a pound of gum, a little grilled rice, and several ounces of hard animal jelly, compounded with a fourth of its weight in gum. This substance is decidedly nutritious; for we are told, that when the whole provisions of a caravan had been exhausted in the deserts between Abyssinia and Egypt, a thousand persons subsisted on gum, which was found to form part of the merchandize; and the caravan reached Cairo in safety, without any remarkable accidents from hunger or disease. The compound of the Negro couriers may possess particular qualities in repelling hunger, such as that which, among the primitive inhabitants of this island, is said to have proved sufficient, if equivalent to a bean, for a whole day; and some of the American Indians, when engaged in long excursions, have similar expedients for blunting the keen sensations which they would otherwise experience. A composition of calcined shells and tobacco juice is formed into a mass, from which, when dry, pills of a proper size, to be kept dissolving between the gum and the lip, are made. Without such artificial preparations, however, long and perilous voyages have been accomplished, without more than a ship's biscuit divided into a number of pieces daily. Captain Inglefield, and eleven men, of the Centaur man of war which foundered at sea in the year 1782, sailed 800 miles in a yawl, while their sole provisions consisted of a twelfth part of a biscuit for each of two meals a day, and a glass of water, continued during ten or fifteen days. Still more perilous was the voyage of Captain Bligh and 18 men of the Bounty, who sailed a great portion of 3600 miles in an open boat in stormy seas, on an allowance of an ounce and a quarter of biscuit daily; and sometimes when a bird, the size of a pigeon, was accidentally caught, it served for a meal to the whole crew. We shall not be much surprised, therefore, at the experiments made by some people on themselves, from which it appeared that fasting on half a pound of bread daily with a pint of liquid was productive of no inconvenience. Still there is an infinite difference between all this and absolute privation, because nutriment is derived from the solids received, and these solids may be of very various descriptions. Sea weed has afforded many grateful meals to famished sailors. In the year 1652, two brothers, accidentally abandoned on an islet in a lake of Norway, subsisted twelve days on grass and sorrel, and suffered nothing in consequence of their diet.

Few instances can be given of absolute privation both of solids and liquids; but in the case above referred to, where 72 persons took shelter in the shrouds of a vessel, fourteen actually survived during twenty-three days, without food, though a few drops of rain were occasionally caught in their mouths as they fell. Some of the survivors also drank sea water, but it was not so with all. In the year 1789, it appears that Caleb Elliott, a religious visionary, determined to fast forty days. During sixteen he obstinately refused all kinds of sustenance, and then died, being literally starved to death. It is said, that not long ago two convicts in the jail of Edinburgh lived fourteen days without food, and receiving liquids only; and in the records of the Tower of London, there is reported to be preserved an instance of a Scotchman, who, strictly watched, was seen to fast during six weeks, after which he was liberated on account of his uncommon powers of abstinence. Morgagni, an Italian physician, refers to an instance of a woman, who obstinately refused all sustenance, except twice during fifty days, and took only a small quantity of water, when she died. An avalanche some years ago overwhelmed a village in Switzerland, and entombed three women in a stable, where there was a she goat, and also some hay. Here they survived 37 days on the milk afforded them by the goat, and were in perfect health when relieved. But one of the best authenticated instances of excessive fasting in modern times, and in which there is no evidence of any particular morbid affection of the body, is related by Dr Willan. In the year 1786, a young man, partly a religious visionary, and partly supposing himself to labour under some inconsiderable complaints, thought to operate a cure by abstinence. He suddenly withdrew from his friends, occupied himself in copying the Bible in short hand, to which he added his own commentaries, and resolved to abstain from all solid food, only moistening his mouth from time to time with water slightly flavoured with the juice of oranges. He took no exercise, slept little, and spent most of the night in reading, while his daily allowance was between half a pint and a pint of water, with the juice of two oranges. In this state of abstinence he persisted 60 days; but during the last ten his strength rapidly declined, and finding himself unable to rise from bed he became alarmed. The delusion which had hitherto impressed him of being supported by preternatural means now vanished, and along with it his expectation of some remarkable event, which should follow his resolution of self-denial. On the sixty-first day of his fast, Dr Willan was summoned to his aid; but the miserable object was then reduced to the lowest state of existence; and although his eyes were not deficient in lustre, and his voice entire, he exhibited the appearance of a skeleton, on which the flesh had been dried; and his personal decay was attended with manifest mental imbecility. Nevertheless with proper regimen, he so far recovered, as in a few days to be enabled to walk across his room; and a clergyman, who had previously been admitted to visit him, had successfully dispelled his religious aberrations: but on the seventh day from the commencement of this system his recollection failed, and he expired on the seventy-eighth from the date of his abstinence. An analogous case has been quoted by the same physician, of an insane person, who survived 47 days on a pint and a half of water daily, during which time he obstinately stood 38 days in the same position. From extreme weakness he lay down during the remainder, still refusing any thing but water; nor did this extraordinary abstinence prove fatal.

Perhaps we should find many examples of fasting for a much longer period, on recurring to morbid conditions of the body; such as that of Janet M'Leod, a young Scotish female, who, after epilepsy and fever, remained five years in bed, seldom speaking, and receiving food only by constraint. At length she obstinately refused all sustenance, her jaws became locked, and in attempting to force them open two of her teeth were broken. A small quantity of liquid was introduced by the aperture, none of which was swallowed, and dough made of oatmeal was likewise rejected: she slept much, and her head was bent down to her breast. In this deplorable state, the relatives of the patient declared she continued to subsist four years without their being sensible of her receiving any aliment, except a little water; but, after a longer interval, she began to revive, and subsisted on crumbs of bread with milk, or water sucked from the palm of her hand. It is not evident that her convalescence ever was complete, and it rather is to be inferred that she always remained in a debilitated condition.

After these extraordinary instances chiefly belonging to our own æra, to which many more might be added, we shall probably be less incredulous in listening to the accounts of the older authors; and although we may refuse to go to the same extent that they have done, we cannot reject those examples which do not exceed the terms of duration here specified. Yet it is impossible to be too careful of imposture, of which the most decisive illustration is given in the case of Anne Moore, just at the moment of making these observations; and in the earlier remarks transmitted to us, we should be equally slow in receiving what is offered as miraculous interposition of supernatural powers. Mankind, always anxious for distinction, falsely conceive that it is to be gained by deluding the credulous with fictitious narratives. Fortunius Licetus published a copious and curious work on this subject, which has now become exceedingly rare. It has cost the author much labour and research, and for the most part it is written in a style more philosophical than common to that age in such subjects. Licetus inclines to make a systematic division of the duration of fasting into different periods, which he designs *short*, *intermediate*, and *long*. The first, he says, is of constant occurrence, is unattended with personal danger, and is limited to three days; the second happens frequently, but life is in hazard, and it embraces an interval within the sixth day. All fasting beyond that time, belongs to the third division, which he also partitions into three classes, each with four subdivisions. The first commences on the seventh, ninth, twelfth, and fifteenth days of abstinence; the second is limited by the twentieth, thirtieth, fortieth, and sixtieth day; the third commences with the third month, includes the sixth, twelfth, and all periods exceeding a year. These rather seem arbitrary divisions it is true, but the author supports them by numerous illustrations, to which we must refer in general, instead of citing them in detail.

In regard to the sensations excited by protracted fast-ng, and its effects on the person of the sufferer; there s a difference resulting from the vigour both of body and mind, to which the influence of climate may be joined, but the most direful and lasting consequences frequently ensue. At first every substance is ravenous-y devoured, to appease the cravings of hunger; every nimal, the most loathsome reptiles, are welcome sus-enance; and a paste is baked by the New Hollanders, omposed of ants and worms, intermixed with the bark f trees. John Lery, who endured the extremity of amine in a voyage to Brazil, emphatically declared, hat a mouse was more prized in the ship than an ox ad been ashore; and he also informs us, that three or our crowns were paid for each. The natives of New Caledonia swallow lumps of earth to satisfy their hunger, and tie ligatures, continually increasing in tight-ess, around the abdomen. They seem to do so with mpunity, although the custom of eating earth in Ja-a, which is done to reduce personal corpulence, is lowly but invariably destructive. Last of all, recourse had to human flesh, instances of which have occurred n all countries of the habitable world, on occasion of amine from sieges, shipwreck, or the failure of ex-ected crops of grain.

Diminution of size, and the rapid prostration of rength, are almost immediately consequent to pro-acted abstinence. The extremities of the natives of ew Holland and the Andaman islands, are of dimen-ons greatly inferior to those of people accustomed to nple supplies of food. The persons of the Arabs of e desert want that rotandity and developement which aracterizes mankind accustomed to abundance of food. ncommon emaciation ensues; the inhabitants of the rmer country, "in times of famine, resemble so many alking skeletons, ready to drop down with weakness;" dividuals, who have suffered want during long voyages, quire to be carried on shore; they faint on the ghtest unusual odour, and are incapable of swal-ving food, except in the smallest quantity, and that th inconceivable pain. There is a class of religious nitents on the confines of Persia, who gain sanctity the practice of austerities. One who devotes him-f to stand for a series of years, with his arms extend- is sparingly supplied with aliment; he is supported h posts when overcome by feebleness, or the an-sh of an unchanged posture; his arms gradually ste, and he grows insensible of the change that been going on. Should he survive the term of bation, which rarely happens, "his body, which is ome emaciated, as light as a feather, and as dry as od, is unloosed, bathed, and anointed with costly tments, and the best white naphtha; more nourish- food is brought, and he is carefully attended to un-e-established; his arms alone remain withered, stiff, motionless, and as hard as timber." Extenuation weakness fellow sudden changes from sustenance animal to vegetable substances, and, as is well wn, those who subsist solely on the latter are not capable of the same personal exertions as those copiously supplied with the former. Along with emaciation, there ensues the suppression of the alvine excretions, though secretions by the kidneys continue, and it is remarkable that drenching the body frequently with water produces an augmentation of the latter.

During this period a material alteration is taking place in the mind; men become wild, and ferocious, they view each other with malevolence, they are quarrelsome, turbulent, and equally regardless of their own fate as of the safety of their neighbours; they actually resemble so many beasts of prey. The sensations of hunger from protracted fasting are not alike in all, or it may be, that immediate languor operates strongly on those by whom it is not so severely felt. But it is certain that, after a particular time, little inclination for food is experienced, though great desire remains of quenching thirst. The Genevese physician describes his hunger as having been keen, but never painful. During the first and second days of abstinence, he became faint on attempting any mental or personal exertion; and a sensation of cold was diffused over his whole frame, more especially affecting the extremities. Captain Inglefield, of the Centaur, expresses his consolotary feelings on seeing one of his companions perish, "that dying of hunger was not so dreadful as imagination had pictured." A survivor of that miserable shipwreck, where so many people hung twenty-three days in the shrouds, observes, that he did not suffer much during the first three from want of food; that after more had elapsed, he was surprised to have existed so long, and concluded, that each succeeding day would be his last. To these examples may be added that of Captain Kennedy, who considered it singular, that although he tasted neither meat nor drink during eight entire days, he did not feel the sensations of hunger and thirst.

Unless for timely succour, the human frame yields under such privations, idiotcy succeeds ferocity, or the sufferer dies raving mad. Should the consequences not be fatal, lasting diseases are frequently occasioned, by the tone of the different organs being injured, sometimes incurable, and sometimes admitting palliation.

It is evident, however, from the preceding observations, that protracted fasting is not so destructive as is commonly credited, and that mankind may, without danger, remain entire days destitute of food. Liquids are an effectual substitute for solids in preserving life, and drenching the body with salt or fresh water, or laving it copiously on the head, materially contribute in averting death by famine. See *Philosophical Transactions*, 1783. *Memoirs of the Manchester Society for* 1785, vol. iii. Lerius *Navigationes in Brasiliam*. *Asiatic Researches*, vol. iv. p. 386. Syme's *Embassy to Ava*, p. 130. Mackay's *Narrative of the Shipwreck of the Juno*. *Annual Register for* 1768 and 1783. *Gentleman's Magazine*, 1789. Licetus, *De his qui diu vivunt sine alimento*. (*c*)

FATA MORGANA, is the name given to an optical phenomenon, sometimes seen in the straits of Messina, between the Island of Sicily and the Italian coast. This remarkable phenomenon, which has not hitherto received any explanation, has been described by Kircher, Angelucci, Scotus, Giardina, Gallo, Leanti, Brydone, Swinburne, and F. Antonio Minasi, the last of whom published a dissertation on the subject at Rome, in 1793.

After having observed the Fata Morgana three times, Minasi has given us the following description of it, which we believe to be the most correct that had hitherto been published.

"When the rising sun," says Minasi, "shines from that point whence its incident ray forms an angle of about 45 degrees on the sea of Reggio, and the bright surface of the water in the bay is not disturbed either by the wind or the current, the spectator being placed on an eminence of the city, with his back to the sun, and his face to the sea; on a sudden there appears in the water, as in a catoptric theatre, various multiplied objects; viz. numberless series of pilasters, arches, castles well delineated, regular columns, lofty towers, superb palaces with balconies and windows, extended valleys of trees, delightful plains, with herds and flocks, armies of men on foot and horseback, and many other strange figures, in their natural colours, and proper actions, passing rapidly in succession along the surface of the sea, during the whole of the short period of time while the above mentioned causes remain.

But if, in addition to the circumstances before described, the atmosphere be highly impregnated with vapour and dense exhalations, not previously dispersed by the action of the wind and waves, or rarefied by the sun, it then happens, that in this vapour, as in a curtain, extended along the channel to the height of about four or five-and-twenty feet, and nearly down to the sea, the observer will behold the scene of the same objects not only reflected from the surface of the sea, but likewise in the air, though not so distinct or well defined as the former objects from the sea.

Lastly, if the air be slightly hazy and opaque, and at the same time dewy, and adapted to form the iris, then the above mentioned objects will appear only at the surface of the sea, as in the first case, but all vividly coloured or fringed with red, green, blue, and other prismatic colours."

Minasi divides these phenomena into three classes; the *marine morgana*, the *aerial morgana*, and the *prismatic morgana*; and he endeavours to prove, that all the appearances are representations of the objects upon the two coasts. He considers the sea as an inclined speculum, on account of the rapid current which runs through the straits; and he supposes it to be divided into different planes, by the contrary eddies which take place when the current changes its direction. He ascribes the aerial morgana, to the refractive and reflective power of effluviæ suspended in the air.

Many other phenomena of a similar kind, have been long observed under the names of Looming and Mirage. In our article ATMOSPHERE, we have mentioned a very singular phenomenon observed by Dr Vince of Cambridge; and Dr Buchan has described another in Nicholson's *Journal*, vol. xiv. All these phenomena obviously arise from the rarefaction of the air in the neighbourhood of the surface of the sea, in consequence of which, a distant object appears to be depressed instead of elevated by the refraction; and it is sometimes seen both depressed and elevated, one of the images having in general an inverted position. Dr Wollaston has investigated this subject with much ingenuity, and has shewn, that this class of phenomena may be imitated, either by viewing a distant object along a red hot poker, or through a saline or saccharine solution, with water and spirit of wine floating upon it. See Nicholson's *Journal*, vol. i. 4to, and vol. xiv. page 340, 8vo. Wollaston, *Phil. Trans.* 1798. Gilbert's *Journal*, vol xvii. p. 183. Dr Thomas Young's *Natural Philosophy*, vol. i. p. 441, 442. Vince, *Edinburgh Transactions* vol. vi. p. 245. Biot, *Mem. de l'Institut.*; and our articles ATMOSPHERE and REFRACTION. (*r*)

FAVERSHAM, is a market-town of England, in the county of Kent, situated on a navigable river, which communicates with the river Swale. The four streets of which it is composed form an irregular cross, having the guildhall and market-place at the centre. Many of the houses are large and handsome, and the streets are well lighted and paved.

The church, dedicated to St Mary of Charity, is supposed to have been built about the time of Edward I. It is spacious and handsome, and is built of flint in the form of a cross, the angles being formed of stone. It consists principally of a nave with aisles, transept and chancel, and there is at the west end a light tower wit
pinnacles, and terminated by an octagonal spire 73 f
high. The interior of the church underwent a thoro
repair in the year 1755, from the designs of D
The tower and spire were erected since that tim
church is 160 feet long and 65 broad, the le
the transept 124 feet, and its width 46. T
no galleries in the church; and the organ,
above £400, is placed in a niche formed b
of the belfry.

The guildhall, or market-house, was b
in 1594, and has an open space between
neath. There is here a free grammar
by Queen Elizabeth, and endowed to t
of £90. There are also two small ch
blished in 1716, and supported chiefly by
subscriptions, for instructing and clothing 12 poor bo
and 12 girls. There are also almshouses, and other good benefactions, for the poor. The buildings of the celebrated abbey of Faversham, were once extensive and numerous. The two entrance gates remained till about 47 years ago, when they were taken down. Nothing now remains but the outer walls of the precincts, to point out the site of the abbey.

The manufacture of gunpowder is carried on to a great extent in the vicinity of Faversham, under the superintendance of a branch of the ordnance. This manufacture is supposed to have been established before the time of Elizabeth. The works were purchased from individuals by government in 1760, and were soon after rebuilt in a safe and substantial manner. The different mills and storehouses are principally situated on the stream that flows from Ospringe. They are constantly at work night and day, the men relieving each other in parties. The quantity of powder manufactured annually, amounts to between 12,000 and 13,000 barrels, which gives employment to about 400 individuals. The mills were blown up in 1781, by the explosion of about 7000 lbs. of powder. The noise was heard at 20 miles distance.

The oyster fishery is the principal source of the trade of Faversham, more than 200 families being supported by it. Before the last war, Faversham oysters were annually exported to Holland to the amount of £3000 or £4000 anually. Besides the coasting trade, Faversham supplies London with great quantities of corn, hops, cherries, apples, and oysters.

The following is the statistical abstract for the parish in 1811, including the out-liberty.

Number of houses	672
Number of families	846
Families employed in agriculture	93
Ditto in trade and manufactures	268
Males	1878
Females	1994
Total population in 1811	3872

See Hasted's *History of Kent*; and *the Beauties of England and Wales*, vol. viii. p. 723. (*w*)

FAYAL, the name of the most western of the Azores Isles, derived from the Portuguese term *Faya*, on account of the great number of birch trees which grow here. It is about 27 miles long and 9 wide. The principal town is called Villa de Horta, before which is the semicircular bay or road of Fayal, about two miles broad, and three-fourths of a mile deep. The depth of water is from 20 to 10 and sometimes 6 fathoms. Round the south-west point of the bay is a cave named Porto Piere, where a ship may lie pretty safely. The position of the town, according to trigonometrical observations, is West Long. 28° 41′ 48″, and North Lat. 38° 30′ 55″. See AZORES, for a general account of the Islands.

FE DE BOGOTA SANTA. See SANTA FE DE BOGOTA.

FEATHERS. See ANATOMY COMPARATIVE, and ORNITHOLOGY.

FEEJEE, the name of a group of islands in the South Pacific Ocean, the most northerly of which were discovered, in 1643, by Tasman, who gave them the name of Prince William's Island. In 1789, Captain Bligh, the third day after his escape from Toofoa, fell in with the easternmost of them in Long. 178° West, and he found that the group extended 4° to the west of the irst island. Several of them, which he saw, had 30 or 40 leagues of coast, and were variegated with hills and vallies; but his defenceless situation prevented him from having any intercourse with the inhabitants. When he returned from Otaheite in August 1792, he passed to the north of those which he had formerly vi- ited, and having crossed his former track, he doubled he most southern of the group, in East Long. 178°, and South Lat. 19° or 15°. The islanders, apparently with hostile intentions, attempted in vain to overtake is ship.

In the year 1794, Captain Barber saw six islands in he western part of the group; and having anchored in bay on the western side of the largest one, his ship was attacked by the natives in a number of canoes, which were soon repulsed. He found the navigation ery difficult and dangerous. Captain Cook was informed that Feejee was a high but fertile island, abounding in hogs, dogs, fowls, and all kinds of fruits.

The Feejeans are a distinct race from the inhabitants f Tongataboo, speaking a different language, and ma- ing use of bows and arrows in battle, besides clubs nd spears. The inhabitants had a high reputation both r mechanical skill and military prowess. Their othing and their earthen vessels were made with great genuity. They are said to eat the bodies of those hom they slay in battle. (*π*)

FELICUDA, (anciently called *Phœnicusa*), is an and on the north coast of Sicily, in the Mediterranean, d one of the most western of the Lipari or Æolian isles. lies 23 miles west of Lipari, in East Long. 14° 21′, d North Lat. 38° 34′, and is about nine miles in cir- mference. The lava which forms the shore, and the mices, glasses, and enamels found every where in the lds, are proofs of the operation of fire in the formation Felicuda. At a distance the island presents the ap- arance of a number of eminences heaped around the es of one central mountain, which rises half a mile ove the level of the sea. The summit of this moun- n resembles a truncated cone, and incloses a hollow feet deep, and about 2640 in circumference, called the *tch of Fern*, which is now in cultivation. It is sup- sed by Spallanzani to have been anciently the crater from whose lava the island was formed. The soil is composed of half pulverulent tufa, resting on lava. There is also a small isolated hill, to the south-east of the principal mountain, and about half its height. It has the appearance of a broken cone, truncated at the top, where it forms a hollow narrowing towards the bottom, and containing pieces of lava imbedded in earthy tufa: the exterior of the hill is lava. Felicuda.

Though yet unprovided with a regular harbour, Felicuda has two bays, the one on the south, the other on the north-east side of the island, by one or other of which a landing may easily be effected, in any direction of the wind.

Minerals. The shore is almost wholly composed of various lavas: those in the north-east bay have for their base a light grey felspar; they include needles of black and fibrous schorl, with small portions of white semitransparent felspar. In many parts they resemble honeycomb, from the depth and regularity of their vacuities, the production of which has been ascribed to the action of gas, when the lava was in a state of fusion. About a hundred and fifty paces to the left of the bay stands a fine rock of prismatic lava, 30 feet high. From the top downwards it is perfectly smooth, to about 12 feet above the surface of the sea, where it begins to assume the prismatic form, dividing into a number of three-sided prisms, and continuing this form under water. The base of this lava is an extremely compact iron-coloured hornstone. It contains a great number of small rhomboidal schorls, with some grains of amorphous felspar. A little farther to the left, is the *Grotta del Bove Marino*; the entrance is 60 feet in breadth, and above 40 in height: it forms a kind of porch, which conducts to a hall 200 feet long, 120 broad, and 65 in height. It is formed in the lava of the shore, whose base is a light porous schorl; it is of a grey colour, interspersed with white shining rhomboidal felspars, and is magnetic at the distance of half a line, but its power is increased by fusion: like the rock already mentioned, it separates into prisms before reaching the water. Beyond this cavern is a high precipice, which descends into the sea, and is composed of many alternate beds of lava and tufa. Spallanzani counted eleven of each. The remaining part of the shore consists chiefly of prismatic lavas, having for their base the hornstone and schorl in the mass.

The lavas of the interior are of three different kinds, of two of which the base is hornstone, and of the third schorl. They are all very compact, and do not present any of those tumours and inequalities which occur in lavas of more recent formation. The tufas are in general of a light spongy nature, pulverulent and argillaceous, and readily absorb water. In them are found the glasses and pumices before alluded to. The glasses occur in small pieces, enveloped in the tufa. Some of them are beautifully transparent, others are of a grey colour, and some are almost quite opaque: the furnace converts them into a vitreous froth. The *pumices* are in great quantity, and always in very small detached pieces. They are of two kinds; the one light and porous, the other entirely without pores, of a smooth fracture, and of considerable weight and compactness. The prevailing colours are red, yellow, and ash-grey. All of them abound with very brilliant scales of vitreous felspar, and in the furnace contract into a shining black enamel, interspersed with the whitish scales of the felspar.

Climate. The climate of Felicuda is bracing and healthy; the

Productions.

air is remarkably pure, and seldom contaminated with fogs or vapours; the soil is scanty, and consists entirely of pulverised tufa. The island, however, abounds in vines, which afford an excellent wine. It has also Indian figs, and some olive trees, and gives a tolerable crop of wheat and barley. The value of the total produce, including that of the vintage, was estimated by Spallanzani at 4000 Neapolitan crowns. Its animal productions are not more numerous than those of the vegetable kingdom. Of amphibious animals, Spallanzani only met with the grey and green lizards, (the *Lacerta agilis* of Lin.) There is not a serpent on the island, nor indeed on any of the group, owing, it is thought, to the paucity of those insects, and other small animals on which they feed.

Inhabitants.

Felicuda contains 650 inhabitants. They are poor, laborious, and happy. Their poverty, indeed, which exempts them even from taxation, gives them at first sight the appearance of extreme wretchedness; but a nearer view opens a scene of unambitious and cheerful tranquillity, which even in its highest anticipations scarcely looks beyond the wants of nature. Their houses are mere hovels, rudely constructed of blocks of lava, and seem hung like the nests of birds to the precipitous cliffs of their mountains. This singular custom was first occasioned by the frequent predatory attacks of the Tunisian corsairs, with which the island was formerly much harassed, and which at length compelled the inhabitants to transfer their residence from the lower parts of the island to those declivities of the mountains, which are less accessible to piratical surprise. Their food, in general, consists of wild fruits, and a sort of black barley bread, placed before them in the coarsest dishes, or on the bare ground, on which they are seated to receive it. They sometimes indulge themselves with the luxury of salt fish and pure water. This last article is extremely scarce, there not being a single spring on the island, which makes it necessary to preserve the rain water in cisterns. Few of these people employ themselves in fishing, in which they use the hook and line. Their principal occupation is agriculture; and it is wonderful with what industry they cultivate, and with what attachment they cling to the wretched soil, which thus scantily repays their ever-patient exertions. "They would not exchange it," says Spallanzani, "for the Fortunate Isles." (U)

FELIS. See MAMMALIA.

FELOOPS, or FELUPPS, a tribe of negroes inhabiting the western coast of Africa, between the Gambia and the banks of the river Casamanza. The whole extent of the territory occupied by them, is about seventy-five miles in length by forty-five in breadth, terminating to the east near the sources of the latter river. It is of great fertility, well wooded, and abounding in rice, cattle, goats, and poultry, with which the traders on the Gambia are copiously supplied. Numbers of tigers, bears, and leopards, inhabit the forests, against which the natives carry on a bold and successful warfare, for the protection of their herds, and sell the skins to negroes of adjoining districts, by whom they are brought to the European settlers.

The Feloops exhibit certain peculiarities in person, manners, and customs, apparently separating them from the rest of the negro tribes by which they are environed.

In stature they are short and stout, but very strong and swift; their skin is coarse, of a deep black colour; and their hair, which they collect on the crown in an erect queue, several inches long, is woolly, and of greater length than that of negroes in general. The beard is allowed to grow, and is collected in like manner, so as to advance in a point projecting some inches from the chin. Their features are fine, bearing greater resemblance to those of the blacks of India than of negroes, but they have a wild and melancholy cast; and the Feloops are said to be of a gloomy, taciturn, revengeful disposition. They hold very little intercourse with their neighbours, and are exceedingly jealous of their own women, who are reputed to possess very few attractions.

These people, in common with other tribes in different parts of the world, cover their face and skin by a kind of tattooing or scarification, with strange and irregular figures. They go almost naked, except for a scanty girdle; and on the wrists, arms, ancles, and thighs, wear tight leather rings or bracelets, so firmly encircling them, that the intermediate flesh rises high above the natural size.

Nothing whatever is known of the religion of the Feloops; but to judge by the number of charms borne about their persons, they are deeply tinctured with the superstitions of the African continent. Their language is peculiar, and uttered with great rapidity in a low guttural accent.

In speaking of the manners of these people, it cannot be denied that they are very imperfectly known to Europeans, because they are shy and reserved, and avoid intercourse with strangers. Their language, too, is reputed difficult, and their traffic being carried on by means of a factor or third person, commonly of the Mandingo nation, offers few inducements to acquire it. Besides the articles already mentioned, grain, and livestock, the Feloops bring great quantities of bees wax to the town of Vintain, which stands by a creek, on the south side of the river Gambia, and sell it to Europeans. But the simple savage is always deeply imposed on; for after having departed with part of the covenanted price received from his factor, the latter himself obtains a considerable balance, emphatically designed "cheating money," as the reward of his trouble. The honey collected in the woods is made into an intoxicating liquor resembling mead. This is one principal ingredient at their feasts, where quarrels, terminating fatally, often ensue when the whole party is in a state of intoxication. One singular feature in their manners is now disclosed, intimately resembling what is denominated the price of blood among other nations. Should a man be killed on such an occasion, a deadly feud is created between his relatives and the murderer, which is transmitted even to posterity. The eldest son of the deceased endeavours to procure his father's sandals, which he wears once a year, on the anniversary of his death, until he finds an opportunity of avenging it. The devoted object seldom escapes; and although we are not sufficiently acquainted with the history of the Feloops to define the interval that may elapse, examples are not wanting among tribes practising similar customs, where it is sometimes not less than twenty years. Nay, the two persons at enmity may often be seen almost in contact, while the one knows he is the object of resentment, and the other only awaits the fit moment of exercising his vengenace.

The Feloops, nevertheless, possess many good qualities: they testify the utmost gratitude and affection towards their benefactors, and whatever is intrusted to their charge is preserved with the most scrupulous fidelity. English property of considerable value has been committed to them at Vintain, and they have invariably manifested the strictest honesty regarding it.

The Feloops are, on the whole, a warlike people, and ferocious in hostility, but they do not seek quarrels, and they enjoy good reputation among the neighbouring tribes. Their arms do not differ materially from those of other Africans on the western coast, and are adapted to the warfare to which they are exposed. They are kilful archers, using bows six feet long, and quivers full of poisoned arrows. One quiver is hung on the ight shoulder, and another on the haunch. Besides hese, five or six lances or assagays are carried in the and, which they dart with surprising force and pre-ision.

The numbers of this people are uncertain. They ave been calculated at fifty thousand, which probably xceeds the truth, and they occupy sixty or seventy illages, the most remote standing in woods near the ise of the river Casamanza. But it is difficult to ascer-ain the numbers of savage tribes, or the extent of their wellings; and particularly so here, where intelligent uropeans have not had immediate access to them. hough the Feloops shun communication with esta-lishments on the river Gambia, it is said to be other-ise with the Portuguese settlements on the Casaman-a, for there they are common and familiar with the ettlers. It has thence been concluded, with some pro-ability, that their reserve towards other Europeans, ori-inates from the policy of the Portuguese inspiring em with distrust. By thus estranging them, all the lvantages of traffic are exclusively preserved. Gol-rry *Voyage en Afrique,* tom ii. Park's *Travels,* p. —18. (*c*)

FELSPAR. See MINERALOGY.

FENCE. See AGRICULTURE.

FENS. See DRAINING.

FENELON, FRANCIS DE SALIGNAC DE LA MOTTE, chbishop of Cambrai, was descended from a very an-nt and illustrious family, and was born in the castle Fenelon, in Perigord, August 6, 1651. He was of weak and delicate constitution; and, until the twelfth ar of his age, was brought up under his paternal roof. was the child of his father's old age, and his early iable dispositions rendered him the object of his ut-st affection and anxiety. There was nothing remark-le in the mode of his education, which was entrusted the care of a private preceptor; but, in a few years, acquired under this instructor a more extensive know-ge of the Greek and Latin languages, than is usual-found at so tender an age; and to this circumstance been chiefly ascribed the perfection of style, which discernible in his earliest productions. When he twelve years old, he was sent to the University of ors, which was not very distant from the residence his family, and where he completed his studies in guages and philosophy. His uncle, the Marquis oine de Fenelon, a lieutenant-general in the army, a nobleman of superior understanding and of sound gious principles, having taken a warm interest in ephew's progress, sent for him to Paris, and placed at the college of Plessis, where he commenced his lies in theology, and where he soon distinguished self so much by his attainments, that he was per-ed to preach in public at the age of fifteen. But wise and discerning relative, rather alarmed than ified by the encomiums which this premature ap-ance had excited, and anxious to secure his nephew's inexperience from the snares of youthful vanity, placed him at the seminary of St Sulpice, under the care of its learned and pious superior M. Tronson. From the example and instructions of this excellent person, the youthful Fenelon derived his relish of those clerical virtues, of which he afterwards exhibited so perfect a pattern; and received those impressions of elevated piety, by which he was so eminently distinguished during the whole course of his life. When he was scarcely sixteen years of age, he formed the determination of devoting himself to the missions in Canada, where the seminary of St Sulpice had a considerable establishment; and neither the influence of his tutor, nor the remonstrances of his friends, were able to shake his purpose. But at length his uncle, the bishop of Sarlat, on the ground of his nephew's extreme youth and infirm state of health, explicitly refused to grant permission for his departure, and ordered him to remain at St Sulpice, that, by longer study and retirement, he might qualify himself for the exercise of the ministry. Having been ordained at St Sulpice, he devoted himself for the space of three years to the diligent discharge of his functions in that parish; and, after that period, was appointed to explain the scriptures to the people on Sundays and festival days. About the year 1674, he was invited by his uncle to Sarlat, and resumed with additional zeal his missionary views, choosing the Levant as the scene of his labours; but his friends succeeded in finding for him a more suitable, yet very similar course of ministration; and, at 27 years of age, he was nominated the superior of an institution for preserving in the faith the newly-converted female Catholics. In this humble employment, which required only the simpler forms of instruction, the more minute details of knowledge, and the milder topics of persuasion, he passed ten whole years in the prime of life; but, while faithfully engaged in these obscure and unhonoured duties, he was acquiring by study and meditation those higher talents which contributed to render him so bright an ornament of the Christian church. Though the Marquis his uncle, with whom he resided, passed his life in religious retirement, yet he retained the acquaintance of a few select friends, to whose notice he introduced his nephew, and in whose society he enjoyed many opportunities of improvement. Among these were the Duke de Beauvilliers, who was afterwards governor to the Duke of Burgundy, and the celebrated Bossuet, who held the situation of preceptor to the Dauphin. He speedily recommended himself to the esteem and confidence of that distinguished prelate; and profited by his instructions, while he shared his intimacy. During this period he produced his first work, a treatise on "the Education of a Daughter," which he wrote at the request of the Duchess de Beauvilliers, and which has been rather imitated than surpassed by future writers on the subject. In 1686, he was placed by Louis XIV. at the head of the missionaries, who were sent to Poitou and Saintonge, to convert to the Catholic faith the Protestants in these provinces, whose pastors had been driven into exile; and having been allowed to choose his colleagues, and authorized to dismiss the military who had hitherto acted as the apostles of the church, he repaired to the scene of his duties with all the zeal of a Romish missionary, tempered with the spirit of Christian conciliation. But though he was received by the people as a minister of peace, and sedulously removed every instrument of coercion, he perceived that his converts were chiefly influenced by fear, in consequence of the violent measures which were pursued in other provinces; and it would seem, that

Fenelon.

his proceedings and progress did not keep pace with the impatience of his employers. In consequence of his own request, he received permission to return to Paris, where he gave an account of his mission to the king in person; and contentedly resuming his humble functions among the "Nouvelles Catholiques," he was more than two years without once appearing at court. He was too indifferent about his personal interests to employ the ordinary means of promotion; and even his unoffending character did not preserve him from the machinations of envy and malevolence. He had been selected for the Bishopric of Poictiers, and his nomination even sanctioned by the king, but it was revoked before being made public; and at the earnest application of the Bishop of Rochelle, who had witnessed his fidelity in the Protestant provinces, he was on the eve of being nominated to assist and succeed that aged prelate; but means were found to prevent also the accomplishment of this plan. In both these cases, his success was obstructed by the secret influence of Harlai, archbishop of Paris, who never forgave Fenelon the decided preference which he had shewn for his rival Bossuet's friendship, and who is said to have gained his ends by rendering him suspected of a tendency to Jansenism. Having published, however, in 1688, his treatise on "the Education of a Daughter," and another on "the Ministry of Pastors," which had both been long approved by his friends in Manuscript, his merits became more generally known; and an unforeseen event suddenly placed him in a situation, which fully displayed the superior lustre of his character. His friend, the Duke de Beauvilliers, having been appointed by Louis XIV. governor to his grandson the Duke of Burgundy, and having been allowed to select his own coadjutors in this important trust, without a moment's delay, nominated the Abbé de Fenelon preceptor to the young prince. Fenelon, equally free in the choice of those who were to act under his direction, selected as subpreceptors the Abbé de Langeron, Abbé Fleury, and his own nephew Abbé de Beaumont; and with these valuable friends, all men of talents and piety, he entered on his arduous office in September 1689. He had, indeed, no ordinary task to fulfil, the formation of a good king to twenty millions of people, and the most unpromising materials in the character of his pupil. The young Duke of Burgundy was naturally irritable, unfeeling, obstinate, proud, impatient of controul, the slave of sensual pleasure, and so furious in his rage, that "it was sometimes feared," says St Simon, "the very veins of his body would burst;" yet the powers of his mind were of the highest order, acute, brilliant, profound. All who were entrusted with the charge of this extraordinary youth, acted as with one mind, and upon the same plan; but Fenelon was the soul, which animated and directed their joint operations. A detail of their proceedings would furnish at once an interesting and instructive work; and some idea of the method pursued may be formed from the Fables and Dialogues which Fenelon wrote for his pupil, and which were severally composed at the moment when the young prince required some fault to be corrected, or some useful maxim to be impressed upon his mind. Several curious particulars have been recorded by Bausset, but we have room only to state the result. So great was the Duke's proficiency in classical attainments, that in his tenth year he wrote Latin with elegance, and was able to translate the most difficult authors with precision; and what was more important, his character was so radically changed by the instrumentality of his preceptor, that his most fearful vices were succeeded by the opposite virtues, and he was rendered mild, affable, humane, patient, humble, and austere towards himself. It was by religious principle, that the sagacious preceptor effected so remarkable a transformation; and so powerful was its influence over the mind of the young prince, that his most imperious caprices were often subdued in an instant by merely pronouncing to him the name of God.

Fenelon conducted, at the same time, and with equal attention, the education of the brothers of the Duke of Burgundy, the Duke de Berry, and the Duke D'Anjou, afterwards Philip V. of Spain; and it may naturally be expected, that the most munificent rewards were conferred upon his services. But nothing could equal the disinterestedness of his conduct, except perhaps the want of generosity in his employers. When he entered upon his office, he imposed upon himself two resolutions, from the observance of which he never deviated. The one was, to ask no favour for himself; and the other, to ask none for his relatives and friends. It appears from his letters to his cousin, Madame de Saval, that, after he had been four years at court, he possessed no other ecclesiastical revenue than the small priory of Carenac, which the Bishop of Sarlat had resigned to him; and that, by the irregularity with which his stipend as preceptor was paid, he was often reduced to the greatest embarrassments. "I am on the point," he writes to the lady above-mentioned, "of dismissing all my servants, unless I soon receive some help. I will not suffer you to make any efforts for me of your own accord. I shall send back what you would lend me. I prefer to suffer. Let them forward to me from Carenac as much money as they can, after having, however, distributed the most urgent alms; for I would rather live upon dry bread, in the strictest sense of the word, than suffer the poor of my benefice to be reduced to the extremity of want." Fenelon, at this very period, enjoyed the highest esteem and confidence of Madame de Maintenon, by whose influence he might easily have supplied his wants, and secured his promotion. In the year 1694, however, the king himself attended to the just claims of a servant, in whose behalf he received no solicitations; and, with apologies for the delay, communicated to him in person his nomination to the Abbé of St Valery. In 1693, he had been admitted a member of the French Academy, and was daily rising in reputation as a writer of eminence. But, while emoluments and honours were at length rewarding his merit, a storm was beginning to gather, which clouded his future days. The celebrated Madame Guyon, who in 1688 had been imprisoned, on account of her heretical notions, in a convent near Paris, had been released by the interposition of Madame de Maintenon, and by her introduced to Fenelon, who had expressed a correspondence of sentiments with her general doctrines of divine love. Several ecclesiastics, alarmed by the increasing influence of her tenets, united, and were partly commissioned, to confer together on the subjects, and to disclose the opinions of the church on the difficult points which it involved. These examinators, at the head of whom was Bossuet, met at the residence of M. Tronson, the early and attached friend of Fenelon; and Fenelon himself, who began to feel how much he was concerned in the result, was frequently consulted respecting the sentiments of other writers on the question. In the mean time, before his supposed errors were made the subject of any enquiry, he was nominated, in 1695, to the archbishopric of Cambrai, and gave a striking instance of his disinterestedness of character, and disapprobation of pluralities, by immediately resigning the Abbey of St Valery. He was required by the King still to retain his situation as preceptor, and to reside at Versailles three months of every year, as the laws of the church allowed, while during the other nine he should communicate directions for the education of his pupils. Scarcely, however, had he arrived at Cambrai, when he heard that Madame Guyon was arrested; and at once perceived that her enemies were powerful, and that their hostility might extend to himself. Her imprudences had irritated Bossuet to adopt the harshest measures against her; and Fenelon's reluctance to concur in the same severe treatment and sweeping censures, rendered him an object of suspicion to many of his ecclesiastical contemporaries, and particulary estranged from him his former familiar friend, the Bishop of Meaux. Having pledged himself, in the course of the various discussions which took place, to give a public declaration of his own sentiments, he wrote his "*Maxims of the Saints,*" which he submitted before publication to the Cardinal de Noailles, to M. Tronson, and to M. Perot, a Doctor of the Sorbonne, an acute scholastic theologian, who had been one of the examinators and censurers of Madame Guyon, and who had long been devoted to Bossuet. With a docility, which extorted their admiration, he altered every passage to which they objected; and received their joint declaration, that his book was correct and useful. No sooner, however, did it appear, in 1697, than it was denounced as heretical; and a scene of almost inexplicable persecution commenced against him, under the conduct of Bossuet, who personally accused him of fanaticism to the king, and determined to be satisfied with nothing less than extorting from him an absolute recantation. The principal question in the controversy was, that Fenelon maintained the existence of a pure and disinterested love towards God; while Bossuet taught, that this love should always have for its foundation the hope of celestial happiness.* The Archbishop of Cambrai resolved to submit his work to the decision of the Pope; and he made this appeal with the full permission of the King. But this would not satisfy the requisitions of his enemies; and, from an amiable desire of conciliation, he entered into a variety of personal discussions and explanations, of which his opponents availed themselves to effect his disgrace at court. He received a peremptory order to retire to his diocese; and was, at the same time, refused permission to plead his cause in person at Rome. His most valuable friends retained their attachment to his person in defiance of all considerations, either of fear or flattery; and the young Duke of Burgundy, having in vain endeavoured to prevent his exile, prevailed at least, (though this favour was soon revoked), that he should be allowed to retain the title of his preceptor. Innocent XII. was very desirous to settle the affair in the most conciliatory manner; but, in compliance with the requisition of Louis XIV. he appointed ten examinators of Fenelon's work, five of whom voted in its favour. The Pope himself was secretly disposed to befriend the accused Archbishop, and is said to have expressed his personal opinion in these words: "The Archbishop of Cambrai has erred from an excess of love to God; the Bishop of Meaux has sinned from a want of due love to his neighbour." It has also been said of the two characters, "L'un prouve la religion l'autre la fait aimer." But a fresh remonstrance from the King of France prevailed with the Pontiff to refer the examination to the assembly of Cardinals; and, after a struggle highly honourable to the friends of Fenelon, a formal, but moderate, condemnation of his book, was issued from the court of Rome in 1699. During the whole course of this enquiry, the mildness and serenity of the Archbishop formed a striking contrast with the asperity and rancour of his enemies; and, when he heard of his sentence, as he was ascending the pulpit on the day of the Annunciation, instantly changing the plan of the discourse which he had prepared for that occasion, he delivered a sermon on the duty of passive obedience, which drew tears of admiration from his hearers. Actuated by a principle of religious resignation to the will of God, and love of peace towards his enemies, he published a formal submission to his sentence. His conduct commanded universal admiration, and the Pope was so touched with his meekness, that he wrote to him a letter with many expressions of respect. In the general feeling of approbation which the whole nation entertained towards the Archbishop, it was expected that he would again be recalled to court, and reinstated in his former functions. But the strongest antipathy against him now appeared to have possessed the minds both of the King and of Madame de Maintenon; and all the circumstances of their conduct concur to confirm the suspicion that there existed some secret and more powerful cause of his late persecution than his theological opinions. Their refusal to authorise his return to Versailles, has been ascribed to the publication of "Telemachus," which a servant of Fenelon's had, without his knowledge, first circulated in manuscript, and afterwards sold to a printer at Paris. This admirable production was denounced by the court as a satire upon the government of Louis XIV.; and the utmost exertions were made to suppress it for ever. In this opinion, though solemnly disclaimed by Fenelon, Madame de Maintenon coincided; and, whatever had been the intention of the author, the king could not but feel that its maxims were completely contradictory of those by which he had been guided. The avidity with which it was perused, and the approbation which it received in every nation of Europe, expressed at least an implied condemnation, if not of Louis himself, yet of the political principles by which his reign had been directed. There are strong evidences, however, of an earlier and more inveterate dislike towards Fenelon, in the heart of the favourite Madame de Maintenon, and to which his future disgrace may be considered as principally owing. That lady, not satisfied with being the mistress, aspired to become the wife of Louis; but the king's confessor, Father la Chaise, referred the point to the archbishop of Cambrai, as the ablest casuist at court. His opinions were hostile to the hopes of Madame de Maintenon; and, from that moment, his ruin was meditated.† But whatever may have been the immediate cause of that avowed or secret hostility to which he fell a victim, there can be little doubt that he had become an object of undefined antipathy to the inhabitants of Versailles; that the unbending integrity of his political morals, and the undeviating purity of his Christian standard, could never have coalesced with the maxims and manners of that unprincipled court; and that, sooner or later, though Madame Guyon had never existed, he must have been compelled to withdraw from the scenes of public intrigue. But the persecution to which he was subjected, only served to proclaim the virulence of his enemies; and his banishment from court, only afforded an opportunity of displaying the virtues of his character as a Christian pastor. His manner of life at Cambrai, was retired, peaceful, and uniform in a remarkable degree. He rose early, as he had been accustomed from his youth, and performed mass every day in his chapel. He dined at noon, according to the practice of those times, and partook only of the simplest food. All the ecclesiastics of his household were admitted to his table, where he promoted chearful conversation, while he preserved the most decorous behaviour. After dinner, he dispatched the more formal business of his diocese; and unless he was induced by the weather, or called in duty, to go abroad, generally retired till half past eight o'clock. About nine, he appeared at supper, where he ate nothing but an egg or pulse; and about ten, his domestics were assembled in the principal room, where an almoner read the evening prayers, and the archbishop pronounced the benediction. The only recreation in which he indulged, was walking; and he took great delight in the placid views of nature, the pious meditations when alone, and the pleasing conversations with his friends, which he enjoyed amidst these rural scenes. In the course of his walks, he would sit down upon the grass to converse with the peasants whom he met, or would visit them in their cottages, to offer the consolations which they required, and would often accept their invitation to place himself at their table, and partake of their homely meals. He preached regularly during Lent in some of the churches of Cambrai; and there was not a single parish or town in his diocese where he had not made a personal visit, and publicly instructed the people. Even the desolations of war did not interrupt his assiduity in the duties of his office; and while his diocese was in the possession of the allied armies of Marlborough and Eugene, he was not only permitted, without molestation, to visit every quarter, but protected by escorts, and received with honours wherever he appeared. When they were informed that any of his property was in their neighbourhood, they placed a guard for its preservation; and the towns and villages under his jurisdiction, became asylums to the inhabitants of the surrounding country. In 1711, when the allied armies approached within sight of Cambrai, the little town of Chateau Cambresis, the principal domain of the Archbishop, was guarded by a detachment of Marlborough's soldiers; but perceiving that as his own forces were in want of provisions, he should no longer be able to prevent them from seizing the stores of grain which it contained, and which the neighbouring inhabitants had deposited there under the protection of Fenelon's name, he informed him of the necessity for removing it, and escorted the carriages which conveyed it to the outposts of the French head-quarters. The worthy prelate availed himself of the security granted to his property, and the safe conduct provided for his person, to furnish relief and consolation to the suffering people under his care. His progress was attended with a temporary suspension of the horrors of war, and the season of his pastoral visits, observes one of his biographers, might justly have been denominated "the truce of God." He opened his granaries to feed the soldiers of his king, and afforded an asylum to the wretched wanderers, whom hostilities had deprived of a home. When his own residence could no longer afford them accommodation, he hired houses for their reception, and often distributed their food with his own hands. He made frequent excursions in order to recover their effects; and even paid from his own purse, the contributions levied by the French government on the curates of his diocese. The French courtiers who served in the army which defended Flanders, carefully avoided him, and even sought to please their superiors by shewing contempt for his character; but his pupil, the Duke of Burgundy, still retained for his preceptor all that affection and respect which his virtues had inspired; and in the first letter which he was permitted to write to him, dated in 1701, strongly expressed the continuance of his esteem, and the disgust with which he had regarded the treatment to which he had been exposed.

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* These two opinions, apparently so opposite and incompatible, are most ingeniously and satisfactorily reconciled by Bishop Horsley in his 2d Sermon on Phil. iii. 15.—See his Sermons, vol. iii. p. 389.

† See *Guardian*, vol. i. Nos. 46, 47, 48; and Voltaire's *Hist. de la siecle de Louis XIV.*

When passing through Cambrai in 1708, to take the command of the army along with Marshal de Boufflers, he obtained permission to visit the Archbishop, but only upon condition that a third person should be present. Their interview was therefore short, and their conversation restrained; but, with a voice and manner full of meaning, the Duke said before his departure, "I know what I owe you; you know what I am to you." This excellent prince, who, by the death of the Dauphin, had become heir apparent of the throne of France, died on the 18th of February 1712; and for many days the anguish of Fenelon's mind was so great, as to alarm his friends with apprehensions for his life. When he received the afflicting intelligence, the only words which he uttered were these, "Every tie is snapped asunder; nothing now holds me to the earth." Yet his resignation to the will of heaven was unreserved; and he was known to have declared, "If there needed no more than to move a straw to bring him to life again, contrary to the divine pleasure, I would not do it." Nine months after this calamitous event, the Duke de Chevreuse, one of his most intimate associates, was carried to the grave; and in 1714, the last of his early friends, the Duke de Beauvilliers, finished the journey of life. The good Archbishop, enfeebled in body, and overwhelmed with afflictions, survived only four months. In the beginning of the year 1715, he was seized with an inflammation in his lungs, accompanied with continued fever. He anticipated the event, and appeared utterly indifferent to all sublunary things. During the continuance of his illness, which lasted seven days, and occasioned him extreme suffering, he was wholly engaged in listening to the reading of the sacred scriptures; and shewed peculiar interest in attending to the last verses of the fourth, and the first nine of the fifth chapters of the second epistle to the Corinthians. He died in the 64th year of his age, on the 7th of January 1715.

In the character of Fenelon, there appears an extraordinary union of intellectual greatness and of moral excellence. The governing principle of his whole mind and conduct was the spirit of Christianity, pure and fervent, which preserved his integrity uncontaminated amidst the snares of a licentious court, and his affections undebased by the superstitions of a corrupted church. But his piety, while unequalled, was of the most conciliating and attractive nature; and his talents, scarcely less unrivalled, were exerted with a degree of modesty and affability, which are not often found to accompany superior endowments. This, indeed, may be considered as the characteristic feature of his mind, that it was compounded of a variety of the rarest qualities, which are so seldom found united in one individual, as to be thought utterly incapable in their very nature. Learning, enlivened by genius, tempered by humility, consecrated by devotion, supported by inflexible integrity, softened by mild benevolence, and graced by attractive manners: this is more like a character which imagination might draw, than human nature realize; yet such, by the testimony of his contemporaries, and by the acknowledgment even of his enemies, was he character of Fenelon. So fascinating was the charm of these combined attractions, that, in the words of the Duke de St Simon, "il falloit faire effort pour cesser de e regarder;" and he obtained so irresistible an ascendancy over every one who approached him, that all his riends, however exalted in rank, or distinguished by alents, became in a manner his disciples. "The Archbishop of Cambrai," says the Chancellor D'Aguesseau, " was one of those uncommon men, who are destined o give lustre to their age, and who do equal honour to human nature by their virtues, and to literature by their uperior talents. He was affable in his deportment, and uminous in his discourse; the peculiar qualities of which were a rich, delicate, and a powerful imagination, but which never let its power be felt. His eloquence had more of mildness in it than vehemence; and he triumphed as much by the charms of his conversation, as by the superiority of his talents. He always brought himself to the level of his company. He never disputed, and appeared to yield to others at the very time hat he was leading them. Grace dwelt upon his lips; e seemed to discuss the greatest subjects with facility, he most trifling were ennobled by his pen; and upon he most barren topics he scattered the flowers of rhetoric. A noble singularity pervaded his whole person; nd a certain undefinable and sublime simplicity, gave o his appearance the air of a prophet. The peculiar ut unaffected mode of expression which he adopted, made many persons believe that he possessed universal knowledge as if by inspiration: it might indeed have been almost said, that he rather invented what he knew han learned it. He was always original and creative; mitating no one, and himself inimitable." The same man who could ascend the pulpit of a country church, o preach to the Flemish peasantry in a language suitable to the simplicity of their manners, and to the weakness of their understandings, and afterwards descend to xplain the catechism to children, shewed himself capable of conducting the concerns of a kingdom. When he affairs of Louis XIV. were in a state of derangement approaching to ruin, the Archbishop of Cambrai enerously rendered him the most valuable political assistance. Amidst the labours of his diocese, he applied imself to devise measures for re-organising the cabinet, and repairing the resources of France, and displayed all the promptitude and sagacity of the most experienced statesman. He even controuled in some degree he military operations of the Duke of Burgundy, whose rrors as a general had made him unpopular; and, in hort, proved himself fully capable of apprehending and llustrating whatever subject presented itself to his consideration.

Of his writings we have left ourselves little room to ve a detailed account; but they are such as must render his name immortal, and contribute essentially to the improvement of the human race. A fire, which consumed his palace at Cambrai in 1697, destroyed many of his most valuable manuscripts, especially those which were connected with the education of his royal pupil, and upon which he had employed the best years of his life,—an event which scarcely disturbed for a moment the habitual serenity of his mind, but which the friends of religion and of literature can never cease to deplore.* His *Treatise on the Education of a Daughter*, published in 1687, though not originally intended for the public, may be considered as a compendium of the most useful precepts on the subject, expressed with the greatest simplicity and precision. His *Treatise on the Ministry of Pastors*, published in 1688, is intended to vindicate the spiritual authority of the church of Rome, and is at least written with a degree of candour and temper seldom found in ecclesiastical controversies. His various replies to his assailants on the subject of Quietism, were composed with astonishing rapidity, yet with a perspicuity and precision which seemed to initiate the reader into the most difficult points in theology, and with a subtilty of genius which confounded the talents of Bossuet himself. He wrote many pieces against the Jansenists, especially *Four Pastoral Letters*, printed in 1704; and his share in this contest is certainly the least amiable part of his conduct. *The Dialogues of the Dead* were composed for the use of his pupil, and intended to fix upon his memory the real merits of the most distinguished characters recorded in history. They were first published in 1712, after the Duke of Burgundy's death, and without the author's name or consent; and it was not till 1730 that a complete edition was given to the world. The *Adventures of Telemachus*, which was not originally designed for publication, but entirely for the instruction of the Duke of Burgundy, seems to have been composed between the years 1693 and 1697; and as it appears to have been designed to remain a secret between the preceptor and his pupil, this admirable performance, had not the lucky treachery of a transcriber prevailed, might have shared the fate of the other papers in the young prince's cabinet, which Louis committed to the flames. His *Demonstration of the Being of a God*, which he published in 1713, is, to say the least, the best book on the subject in the French language. His *Letters on Religion and Metaphysics*, written to the Duke of Orleans, were published after his death, and are chiefly suited to a member of the church of Rome. His *Dialogues on the Eloquence of the Pulpit*, were composed in his youth, but never made known during his life, and not published till the year 1718. This production may be pronounced, with Cardinal Maury, to be the best didactic work for preachers, and to be founded upon the principles of nature and good sense. His *Lives of the Ancient Philosophers* is an excellent elementary work for youth; and a very neat translation, recently published by the Rev. John Cormack, has made it accessible to the English reader. His *Œuvres Spirituelles*, a collection of letters to his friends, also published after his death, contain many maxims of the most sublime piety, and many excellent rules of conduct in the various circumstances of life. The few sermons which have been printed from the pen of Fenelon, were composed during his youth for particular occasions, and furnish no idea of his usual pulpit addresses. The discourse which he delivered in 1707, at the consecration of the Elector of Cologne, was adapted to the magnificence of the ceremony, and proves his powers to have rivalled the most eminent orators of his time; but it was his ordinary practice, according to the maxims which he inculcates in his Dialogues on Eloquence, to write nothing more of his sermons than the principal heads—a practice which his astonishing fertility of mind and fluency of expression rendered safe in his hands, but which ordinary men would do well to follow with caution. Those who wish to know more of this extraordinary man, are referred to Querbeuf's *Vie de Fenelon*; Ramsay's *Hist. de la vie de M. Fenelon*; *Eloge de Fenelon*, par M. D'Alembert; and particularly Bausset's *Life of Fenelon, translated by Mudford.* (q)

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* Louis XIV. is said to have committed to the flames, with his own hand, all the letters of Fenelon to the Duke of Burgundy, with ly one exception, which Madame de Maintenon preserved, and sent to the Duke de Beauvilliers.

FENTON, Elijah, an English poet of some note, was born near Newcastle in Staffordshire, of an ancient family, whose estate was very considerable. But he happened to be the youngest of eleven children, and was therefore necessarily destined to some lucrative profession. Accordingly, he was first sent to school, and afterwards to Cambridge; but doubting the legality of the government, and refusing to qualify himself for public employment, by taking the requisite oaths, he sacrificed his interest to his conscience, and left the university without a degree.

Fenton was thus excluded from the ordinary and regular sources of occupation and emolument, and reduced to the necessity of seeking an uncertain and fortuitous livelihood. The obscurity attending such a mode of life, renders it impossible to trace his varying circumstances, or to discover what means he used for his support. It is certain, however, that he kept his name unsullied, and that his character has never been subjected to any mean or dishonourable imputation.

He was a while secretary to Charles, Earl of Orrery, in Flanders, and tutor to the son of that nobleman. At one time, he was assistant in the school of Mr Bonwicke in Surry, and at another kept a school of his own at Sevenoaks in Kent, which he brought into considerable repute; but was persuaded to leave it, in 1710, by Mr St John, under a promise of some more honourable employment, of which, however, he appears to have been disappointed.

In 1707, he published a collection of poems, which procured him admission to the company of the wits of his time; and his amiable manners made him be esteemed by all who knew him. Although he professed the principles of a non-juror, he zealously employed his pen in the praise of Queen Anne; and very liberally extolled the Duke of Marlborough, when he was at the height of his glory. But his elegant penegyrics do not seem to have procured him any patronage from the great.

Pope is said to have once placed him in a situation from which he might have derived great advantage. Craggs, when he became secretary of state about 1720, feeling his want of literature, desired Pope to procure him an instructor, by whose assistance he might supply the deficiencies of his education. Pope recommended Fenton, and his choice proved acceptable to Craggs. But the small-pox unfortunately carried off the patron, and put an end to the pleasing expectations of Fenton.

When Pope resolved to engage auxiliaries in the translation of the Odyssey, he distributed twelve books between Broome and Fenton. The books allotted to the latter, were the first, the fourth, the nineteenth, and the twentieth. In what manner Fenton performed the task assigned to him, is well known to the readers of poetry.

In 1723, he exhibited his tragedy of *Mariamne*, to which Southern, at whose house it was written, is said to have contributed such hints as his theatrical experience enabled him to supply. When the piece was shewn to Cibber, he rejected it, and insolently advised the author to engage himself in some employment of honest labour, by which he might obtain that support which he could never hope to derive from his poetry. The play, however, was performed at the other theatre; and the petulant judgment of Cibber was practically confuted by general applause. Indeed the representation was eminently successful, and Fenton's profits upon this occasion are said to have amounted to near a thousand pounds.

It was probably after the representation of his tragedy, that he undertook to revise the punctuation of Milton's poems, which, as the author neither wrote the original copy, nor corrected the press, was supposed to be capable of amendment. To this edition, he prefixed a short and elegant account of Milton's life. He likewise published, in 1729, a very spendid edition of Waller, with notes, often useful and entertaining, but abounding too much in liberal quotations from Clarendon.

The latter part of Fenton's life was spent in quiet and easy circumstances. Upon Pope's recommendation, he had been invited by the widow of Sir William Trumbull to educate her son, whom he first instructed at home, and afterwards attended to Cambridge. Having acquitted himself in this business to the satisfaction of his patroness, the lady afterwards detained him, as the auditor of her accounts, at her seat of Easthampstead, in Berkshire, where he died in 1730.

Fenton was large in stature, and inclined to corpulence, which tendency was increased by a sluggish and sedentary mode of living. His moral character stands unimpeached; and his manners and conversation were so amiable and engaging, that all his acquaintance treated him with fondness, and spoke of him with paise. As a poet, he did not discover much inventive genius; but he has a good title to be considered an accomplished scholar, and a skilful versifier.

Pope, who had lived in habits of sincere friendship with Fenton, honoured his memory with the following epitaph:

> "This modest stone, which few vain marbles can,
> May truly say, here lies an honest man;
> A poet bless'd beyond the poet's fate,
> Whom heav'n kept sacred from the proud and great;
> Foe to loud praise, and friend to learned ease,
> Content with science in the vale of peace.
> Calmly he look'd on either life, and here
> Saw nothing to regret, or there to fear;
> From nature's temp'rate feast rose satisfied,
> Thank'd heav'n that he had liv'd, and that he dy'd."

(z)

FERDINAND. See Spain.

FERE La, the name of a town of France, in the department of the Aisne. It is situated near the river Sarre, which runs into the Oise. The town is very long, and contains many excellent houses. It was strongly fortified by Cardinal Mazarine, but is now dismantled. In approaching it from Laon, we pass over a fosse, crossed by a paltry wooden bridge, and enter it by an old gate. A stream, with several mills upon it, runs through the town. On leaving the town for St Quintin, the writer of this article perceived a branch of the St Quintin canal, where many vessels loaded with coals were lying close to the town. The surrounding country is rich and well wooded. Number of houses 550. Population 2604. (w)

FERGUSON, James, a celebrated lecturer, and writer on astronomy and other branches of natural philosophy, was born at Keith, a small town in the county of Banff, in the north of Scotland, in the year 1710. While his father was teaching his eldest son to read the Scotch Catechism, James was busy in learning the same lesson, without the knowledge of any person, and as soon as the Catechism was unemployed, he studied the lesson which had been taught to his brother, and, on the occurrence of any difficulty, he had recourse to an old woman who lived in the neighbourhood. Some time afterwards, his father was astonished to find James reading by himself. He immediately taught him writing, and, with about three months attendance at the grammar school of Keith, this was all the education which our author ever received.

When he was about seven or eight years of age, a part of his father's roof fell in, and a prop and a lever were applied to an upright spar to raise it to its former place. The facility with which it was effected excited the astonishment of the young mechanic, and led him to think on the means by which it was accomplished. He immediately began to construct levers; he discovered that the power was proportional to the length of the different parts of the lever on either side of the prop. He invented the wheel and axle, by endeavouring to make a lever that would raise bodies to any height; and by means of a turning lathe of his father's, and a little knife, he was enabled to make models of these different machines. Ferguson afterwards wrote out a short account of these machines, illustrated with figures; and upon shewing it to a gentleman, he was surprised to learn that the same things had been known before, and was much pleased to observe that his own account coincided with what he found in other books.

In consequence of his father's poverty, James began the occupation of a shepherd, and hence he has been ridiculously represented by Lalande as having been shepherd to the king of England for Scotland.* His nights were now spent in studying the stars, while in the day-time he made models of mills and spinning wheels. Our author next went into the service of a farmer of the name of James Glashan. When his work was over, he went into the fields with a blanket about him, and having stretched a thread with small beads upon it, he slid the beads till they hid particular stars from his eye, and then laying the thread down upon a a piece of paper, he marked the stars upon it according to their respective positions. His master at first laughed at this apparently ridiculous occupation; but as soon as he knew the object of it, he not only encouraged him to proceed, but often performed young Ferguson's work with his own hand, that he might leave him time during the day to make clean copies of his rude planispheres. He soon after received from the minister of Keith a map of the earth, and compasses, ruler, pens, ink and paper, for the purpose of copying it; and his generous master frequently took the thrashing flail out of his hands and worked himself, while Ferguson was sitting beside him in the barn busy with his ruler and compasses. Upon his return to the minister of Keith with the copy of his map, he saw a man of the name of Cantley painting a sun-dial, and shewed him the copy of the map. Cantley was butler to Mr Grant of Achoynaney, and appears to have been a man of singular attainments. Ferguson had the good fortune to be introduced to Mr Grant, who invited him to live in his house,—a request with which he gladly complied as soon as his term of servitude was over. Cantley taught him decimal arithmetic and algebra, and they had just begun to geometry, when Cantley left the service of Mr Grant for that of the Earl of Fife, who lived at several miles distance. "Cantley," says Mr Ferguson, "was the most extraordinary man that I ever was acquainted with, or perhaps ever shall see; for he was a complete master of arithmetic, a good mathematician, a master of music on every known instrument except the harp, understood Latin, French, and Greek, let blood extremely well, and could even prescribe as a physician on any urgent occasion."

Having received from this extraordinary butler a present of Gordon's *Geographical Grammar*, Ferguson constructed a globe from the description which is there given of it; and having delineated upon it a map of the world, he was enabled to solve all the common problems in geography and astronomy.

Ferguson next went into the service of a miller, expecting to have sufficient time to study decimal arithmetic and geometry. His master, however, fond of drinking, left him the whole charge of the mill, and almost starved him for want of food. As soon as he had recovered the strength which he had lost by the poverty of his diet, he went into the service of a Dr Young, who acted in the joint capacity of a farmer and a physician, and who promised to instruct him in the medical profession. This new master, however, was as bad as the former one. He never even shewed him one of his books, and overwrought him to such a degree, that at the end of three months he was obliged to leave him in a state of great debility, and without receiving a farthing of wages. This inhuman doctor did not even give him any medical advice, and it was only by medicines from his old friend Cantley, who lived at 12 miles distance, that he recovered his strength. About that time he constructed a wooden clock, the frame of which was of wood, the hours being struck on the neck of a broken bottle instead of a bell. Sometime afterwards, when a gentleman was riding past his father's house, he asked him what o'clock it was; and having received a very good-natured answer, he begged of him to shew him the inside of his watch, as he could not conceive how it went without a weight and a string. The gentleman kindly complied with this request, and not only shewed him the inside of his watch, but explained to him very clearly in what manner the box was carried round by the uncoiling of the spring. Ferguson then tried to construct a watch with wooden wheels, and a whalebone spring; but upon putting on the balance, he found that the teeth of the wheels were too weak to bear the force of the spring, although the wheels ran fast enough when the balance was taken off. He inclosed the whole in a wooden case, a little larger than a breakfast cup; but a clumsy neighbour one day looking at the watch, allowed it to fall, and crushed it to pieces with his foot. Ferguson was next employed in cleaning and repairing clocks; and when he was living at the house of Sir James Dunbar of Durn, he painted a map of the celestial and terrestrial globe, upon two large spherical stones on the top of his gateway. These globes had their axes parallel to that of the earth, and not only served for dials, but exhibited a number of interesting geographical phenomena. Having drawn some patterns for needlework for Lady Dipple, (sister of Sir James Dunbar), he was very extensively employed in this work by the ladies in the vicinity, and he received so much money from his new employment, that he was often able to relieve the wants of his indigent father. Lady Dipple had the goodness to invite him to Edinburgh, and offered him a year's bed and board at her house, that he might have an opportunity of acquiring a knowledge of painting. He drew portraits of several persons in Edinburgh; and, by the patronage of the Marchioness of Douglas, he obtained a considerable deal of lucrative employment, and thus began a profession which he followed for 26 years. During his stay of two years in Edinburgh, he took a violent inclination to study medicine, and he forsook for a time all his favourite studies. He then went to the country with a cargo of medicines and plasters, but with a very scanty knowledge of the art, and began to practise medicine at the place of his nativity. He soon saw, however, that he was an unsuccessful practitioner; and finding that no one paid him for his medicines, he went to Inverness for the purpose of resuming his profession as a painter. During his stay at Inverness, he recommenced his astronomical studies, and after much labour, he invented and completed a machine called the *Astronomical Rotula*, for exhibiting the eclipses of the sun and moon. Mr Macbean, one of the ministers of Inverness, compared the results given by this machine with the calculations given in the common almanac, and found them nearly the same. At his advice, he wrote to the celebrated Colin M'Laurin, Professor of Mathematics in Edinburgh, and requested his opinion of the new instrument. M'Laurin returned him a friendly answer, and requested from him a drawing of his rotula, that he might examine it, and endeavour to procure a subscription for the purpose of getting it engraved upon copperplates. Mr Ferguson immediately complied with this kind request, and a handsome subscription was obtained through the influence of the Professor. The plates of the rotula were engraved and published, and went through several impressions, till the year 1753, when they were rendered useless by the change of style. When he went to Edinburgh, he was received with the greatest kindness by M'Laurin, who shewed him his orrery, but was not able to let him see its construction. Ferguson immediately set to work, and constructed an orrery of wood, which exhibited almost all the leading phenomena in astronomy. M'Laurin was so much pleased with this machine, that he desired Ferguson to read a lecture upon it before the mathematical class. He soon afterwards, in 1743, made a smaller and a neater orrery, having all the wheels of ivory, and he took it with him to London, where it was bought by Sir Dudley Rider.

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* *Berger au roi D'Angleterre en Ecosse.* Astronomie de Lalande, tom. i. p. 163.

When he reached London, he began his old profession of portrait painting, amusing himself at his leisure hours with his astronomical studies. He now constructed a simple machine for delineating the moon's path and that of the earth, on a long piece of paper laid on the floor. This machine was shewn to Martin Folkes, President of the Royal Society, who took Mr Ferguson to the meeting of the Society that evening, when he shewed his instrument, and explained the use of it. When the Society was dismissed, one of the members, Mr John Ellicott, a celebrated watchmaker, asked Ferguson to dine with him at Hackney, and upon that occasion he shewed him that he had invented and constructed the very same machine many years before.

In 1747, Mr Ferguson published a dissertation on the phenomena of the harvest moon, with the description of a new orrery with only four wheels. In 1748, he read lectures on the eclipse of the sun that happened on the 14th of July of that year. He afterwards read astronomical lectures on an orrery which he constructed, and which he has represented in the 6th and 7th Plates of his *Mechanical Exercises.* He then began to construct an apparatus for lectures on mechanics and other branches of experimental philosophy. These lectures were repeated in various parts of the kingdom, and added both to the fame and wealth of our author. In the year 1754, Ferguson published "A brief Description of the Solar System, to which is subjoined an Astronomical Account of the year of our Saviour's Crucifixion, and likewise an Idea of the Material Universe, deduced from a Survey of the Solar System." In 1756, he published in one vol. quarto, one of his best works, entitled "Astronomy explained upon Sir Isaac Newton's Principles, and made easy to those who have not studied Mathematics." This work was written with such uncommon perspicuity and plainness, that it was translated into the German and Swedish languages, and has undergone no fewer than thirteen or fourteen editions. A new edition of it has lately been published by Dr Brewster, in 2 vols. 8vo. containing an account of all the new discoveries in the science since the time of Ferguson.

About this time Mr Ferguson was introduced to his present Majesty, then Prince of Wales, who attended his lectures, and took great pleasure in conversing with him on astronomical subjects. Mr Ferguson received several presents from the prince, and when he ascended the throne, he allowed him £50 a year out of his privy purse, which was regularly paid to him without any deduction.

In 1760, Ferguson published his "Lectures on Select Subjects in Mechanics, Hydrostatics, Hydraulics, Pneumatics, Optics, Geography, Astronomy, and Dialling," &c. This work, which is perhaps the best and the most useful that he ever wrote, passed through several editions, and contributed more to the diffusion of mechanical knowledge among all classes of people than all the works that have been written upon these subjects. A new edition of it in 2 vols. 8vo, with an Appendix, containing an account of all the recent inventions and discoveries, was published by Dr Brewster in 1805, and a second edition in 1806.

In 1761, he published his "Plain Method of determining the Parallax of Venus by her Transit over the Sun, and thence, by analogy, the Parallax and Distance of the Sun, and of all the rest of the Planets." In 1763, he was elected a Fellow of the Royal Society of London, and was excused the payment of the usual fees, which had only been done in the case of Sir Isaac Newton, and of that ingenious and self-taught mathematician Mr Thomas Simson of Woolwich. In the same year he published his "Astronomical Tables and Precepts for calculating the true Times of New and Full Moons, and shewing the Method of Projecting Eclipses from the creation of the World to A. D. 1800, to which is prefixed a short Theory of the Solar and Lunar Motions." In 1767 he published "Tables and Tracts relative to several Arts and Sciences," and also "A Supplement to the Lectures on Mechanics, Hydrostatics, &c." which is annexed to all the subsequent editions of that work. His "Young Gentleman's and Lady's Astronomy familiarly explained, in ten Dialogues," appeared in 1768, and was reprinted in 1769, under the title of, "An easy Introduction to Astronomy, for young Gentlemen and Ladies." This little work has gone through eight editions, and was translated into German in 1771. Madame Genlis remarks, in her preface to the "Tales of the Castle," that this work is so perspicuous, that a child ten years old may completely understand the whole of it. In the year 1770, he was chosen a member of the American Philosophical Society; and, in the same year, he published his "Introduction to Electricity." His "Select Mechanical Exercises, shewing how to construct different Clocks, Orreries, and Sun-Dials, on plain and easy Principles," &c. appeared in 1773, and were accompanied with an account of his life, written by himself. In 1775, he published "Two Letters to the Rev. John Kennedy, containing an account of many mistakes in the astronomical part of his scriptural chronology, and his abusive treatment of astronomical authors." These were followed by a third letter on the same subject. In the same year he published his last work, entitled "The Art of Drawing in Perspective, made easy to those who have no Knowledge of the Mathematics." This work has gone through several editions, and was translated into French by P. R. Leveque. Besides these works, Mr Ferguson communicated several papers to the Royal Society, which were printed in the Transactions of that learned body; but as the most important of them were reprinted in his own works, it is unnecessary to give any enumeration of them at present. Mr Ferguson had always a weak constitution; and, after struggling against a lingering illness, he died on the 16th of November, in 1776, in the 66th year of his age, leaving behind him an only son, who is still alive, and to whom he bequeathed a very considerable sum of money, which he had made by his lectures and his various works. (π)

FERMANAGH, a county of Ireland, in the province of Ulster. It is bounded on the west by Leitrim, on the north by Tyrone and Donegal, on the east by Tyrone and Monaghan, and on the south by Cavan and Leitrim. This county is of very uneven surface; it abounds in hills, many of them of great height, and boggy; and on the borders of Tyrone and Cavan, and especially of Leitrim, it is particularly mountainous. These high grounds afford a good coarse pasture for young cattle; and most of them are said to be capable of great improvement. But agriculture is not in a flourishing condition; there is a want of enterprize, of skill, and of encouragement. Nothing can shew more clearly the barbarous state of husbandry in this district, than the fact, well authenticated, that so late as the year 1808, it was the practice in some places to plough by the tail! In the northern part of the county, the farms are of a large size, and the high grounds tolerably productive; and though there is but a small portion of the land in tillage, the system of management is superior to what prevails in the neighbourhood. Little wheat or clover is sown. Oats are more common, and so is barley. In some quarters, when calculating the most profitable crop, they estimate four stone of barley, and six of oats, to a gallon of whisky. Potatoes are quite common. In 1809, about 5000 Irish acres were supposed to be sown with flax. In the neighbourhood of Florence-court, the farms consist of from two to 20 acres each, and belong almost wholly to manufacturers. The grazing tenures are from 100 to 300 acres. After all, the profits of farming must be considerable, if Mr Wakefield's information be correct, that "Enniskillen market is attended weekly by about 30 or 40 farmers from the vicinity, whose circumstances enable them to eat meat daily, and to drink port wine." On the superior pasture lands, there are cattle and sheep of a large size. Lord Belmore's sheep at Castlecool, when fat, weigh 30 lb. per quarter. A considerable part of the county is occupied with dairies. There is a small breed of cows here similar to those in Down. There are no flocks of sheep: the number of this animal is small, and the breed in general very inferior.

Labour is paid as often in money as in conveniences: the bound labourer generally in the latter. In 1811, the prices of labour, provisions, &c. were as follow: a man, the year round, 1s. and a woman 6d. per day; a carpenter, per day, 3s. 6d. and if constantly employed, 2s. 6d.; a mason, per day, 2s. 6d.; a thrasher, per day, 1s. 1d., or, by piece-work, from 6d. to 8d. per barrel of oats, 8d. to 10d. per do. of barley, and 1s. 1d. to 1s. 8d. per do. of wheat; a car and horse per day 2s. 2d.; a saddle-horse per do. 5s. 5d.; a plough per do. 11s. 4½d., and, for ploughing and sowing an acre, from 26s. to 36s.; a blacksmith, per stone of work, 1s. 6d., or per day 2s. 6d.; turf, per kish, 2s.; sea-coal, per barrel, 4s. to 5s.; culm, per do. 3s.; lime, per do. 1s. 8d. to 2s.; a car, mounted, £4, 10s.; potatoes, per stone, 2d. to 4d.; salt butter, per cwt. £4, 13s. 4d.; fresh do. per lb. 1s.; hay, per ton, £3 to £4; whisky, per gallon, 7s. 9d. to 10s.; strong ale, per quart, 4d.; porter, per gallon, 1s. 3d.; beef, per lb. 6d.; mutton, 7d.; pork, 3d.; lambs, per score, £18 to £22; eggs, per score, 6d.; cheese, per lb. 1s. 6d.; bacon, per do. 6d.; shoeing a horse, 4s.; shoes, per pair, 11s. 4½d.; salt, per stone, 1s. 5d.; undressed flax, per cwt. £4, 10s. to £5; wool, per stone, 22s. to 20s.; fowls, per couple, 1s. to 1s. 6d.; wheat, per barrel, £2, 3s.; barley, do. 19s.; oats, do. 13s. 6d.; quartern loaf of wheaten bread, 1s.; flour, 1sts, per cwt. £1, 9s.; 2ds, do. £1, 8s.; 3ds, £1, 4s.; oatmeal, per cwt. 16s.; labour in harvest of hay and corn, per day, 2s. to 3s.; mowing grass, per acre, 5s.; rabbits, per couple, 1s. 8d.; milk, per quart, 2d.; corn acre of oats (tithe free to the tenant), per acre, £6 to £8; do. meadow (according to weight of grass, do.), £6 to £9; do. potatoe land, do. £6, 16s. 6d. to £8, 8s.; do. flax, per rood (tithe free), do. £2, 5s. to £2, 10s.

Some parts of this county are very bare of trees, but other parts are extremely well-wooded, and upon the whole may be considered as superior in this respect to any district of Ireland. The ash is very common, running along the hedgerows, and on the northern side of Lough Erne appearing like a weed of the country: it is, however, of modern introduction. Beech grows here to a large size. There are also oaks, firs, sallows, and hazels. Elm is seldom raised. At Lough Erne, the yew grows to an astonishing bulk. The only kinds of wood found in the bogs, are fir, oak, and yew. Besides wood, the inhabitants of this county make use of turf and coal as fuel.

Mr Wakefield computes the average rental of this county at £1, 5s. per green acre. Of course there is a great variety in the rents of land, arising from quality of soil and other circumstances. At Florence-court, land lets at £1, 10s. per acre: near Enniskillen, it lets at £8, 8s. per corn acre. In general the leases run for three lives, or thirty-one years: of late the period adopted is twenty-one years and one life. There are here a few estates whose rental is from £1500 to £2000; but by far the greatest number of the estates are large, and there is no intermediate step between the proprietors and the leaseholders. Lord Enniskillen has an estate of £13,000 per annum, as also Colonel Archdale, and Mr Brook of Brookboro. The Marquis of Ely, Lord Belmore, and Sir James Caldwell, have property of from £6000 to £7000 per annum each. There is a good deal of church property belonging to the see of Clogher.

There are several lakes in this county, but the most remarkable is Lough Erne. It consists properly of two lakes, the upper being nine miles long, and from one and a half to five wide, and the lower one about ten miles in length, and from two to eight in breadth. The two are connected by a broad winding channel of about six miles, resembling a river. The ground occupied by Lough Erne is supposed to be 88 square miles. Its scenery is remarkably fine and striking, comprehending both the beautiful and the grand. There are in it between three and four hundred islands, some of them large and fertile, and inhabited, many of them well wooded, the whole of them disposed in a very picturesque manner, and affording a variety of rich and interesting prospects. The Erne and several other rivers run into it; it discharges itself at the north-west end by a current of about seven miles, which runs very rapidly, and at length precipitates itself over a grand cataract into the sea at Ballyshannon. The falls of Belleek are esteemed very beautiful, and deserving of the traveller's attention. Lough Erne contains all the fish common to fresh water lakes. The salmon here grow in a wonderful manner; some young ones having been found to increase at the rate of 1 lib. a week. Great quantities of eels are caught near Enniskillen; eighty dozen sometimes in one night. Near the falls of Belleek there is an eel weir, belonging to Mr Pakenham, which lets at L.120 per annum, and near it there are three others which let at L.100 each.

The chief sources of wealth to the inhabitants are the line manufacture and the rearing of black cattle. The linen produced here is what is called 7-8ths. There are several of those bleach-greens, which finish for sale the bleached linens that are sent to England. Illegal distillation is carried on to a considerable extent. There are mills for grinding oats, but none for grinding wheat.

The principal, and indeed the only town of note in Fermanagh, is Enniskillen. It is situated on an island formed by the river or channel which unites the two lakes.

This county contains rich iron ore and coal. On Lord Enniskillen's estate, west of Lough Erne, there are quarries of marble. It is brown and white, beautifully veined, and of a fine grain.

Fermanagh is divided into two by Lough Erne; the division on the east of the lake containing five baronies, and that on the west containing three. It sends three members to parliament, two of these being from the county, and one from the burgh of Enniskillen. The freeholders in the county amount to 5000; and political influence is so situated, that if the Earl of Enniskillen, Mr Brook, and Mr Archdale be unanimous, they may return what member they please. Enniskillen has twelve self-elected burgesses; and the Earl of Enniskillen is patron.

There are only 18 parishes in the county; 15 of them are in the diocese of Clogher, and the other three in that of Kilmore. The Protestants are to the Catholics in the proportion of one to three. The hostility of the former to the latter is carried to a high pitch of violence. In every respect the Catholics are discouraged and kept down. All the greatest proprietors are Protestants, and members of the established church. The Protestant dissenters are few in number. Sir Richard Hardinge has an estate of 81 farms, and the tenants in 79 of these are Protestants.

According to Dr Beaufort, Fermanagh contains 719 square miles, or 455,298 acres English measure, the length being 43 miles, and the breadth 33. Of these, Lough Erne occupies 76,311. Mr Wakefield makes the superficial contents 694 English square miles. The population of the county is 71,800, and the number of houses 11,969, being six individuals to a house. Excluding Lough Erne, there are about 31 English acres to a house, or 5½ acres to each individual. See Newenham's *View of Ireland*; Wakefield's *Statistical Account of Ireland*; Beaufort's *Memoir of a Map of Ireland*; and Young's *Tour through Ireland*. (τ)

FERMAT (Peter), an eminent French mathematician, who was born at Toulouse in 1590, and died in 1663. He was cotemporary with several mathematicians of the first order, among whom may be mentioned, Pascal, Des Cartes, Roberval, Torricelli, Huygens, Meziriac, Carcavi, Wallis, &c.; and furnished solutions of all the more difficult problems which these illustrious men were in the practice of proposing to one another. His predilection for numerical researches, led him to direct much of his attention to prime numbers, a subject which had been almost entirely neglected since the days of Eratosthenes. In these researches he afforded striking proofs of the superiority of his genius, by the discovery of many general and curious properties of numbers which have no divisors, and such as are composite. The indeterminate analysis also occupied a good deal of his attention; and though Bachet de Meziriac had already greatly extended and illustrated the Diophantine problems, his researches were far surpassed, in elegance, simplicity, and generalization, by those of Fermat. When Pascal was engaged at Paris in investigating the nature of figurate numbers, Fermat was eagerly prosecuting the same subject at Toulouse, by a different train of investigation; and, indeed, on many occasions, these two great men were frequently led to the same results, by methods of inquiry which had little resemblance to each other. Such interferences in their pursuits, did not, however, weaken the friendship to which the conformity of their studies alone had given birth; and, though they were never personally acquainted, they uniformly did justice to the merits of each other, with a liberality which is unknown to little minds.

Fermat was scarcely more distinguished as a mathematician than as a general scholar; and, like most of the learned men who flourished in the age in which he lived, he cultivated jurisprudence and elegant literature with no less assiduity and success, than geometry and algebra. The universality of his genius, and the extent of his attainments, procured the esteem of his fellow-citizens, and raised him to the dignity of a counsellor in the parliament of his native city.

But while we are disposed to admit the originality that characterizes the investigations of Fermat, we cannot acquiesce in opinion with a modern writer of very high authority, we mean La Place,* who affirms, without any sort of proof, that he was the real inventor of the differential calculus. The controversy on this subect has already been laid at rest; and, as all the coemporary writers were unanimous in ascribing the invention either to Newton or Leibnits, the most unexceptionable evidence is now necessary, to support the claims of a third person to any share in the merit of the discovery. Fermat, indeed, in some of his investigations, employed methods resembling the fluxionary calculus; and the same thing had been done by Roberval and Pascal, in treating of the properties of the cycloid; but the circumstances which constitute a right to any important invention, must be founded, not upon obscure and indirect hints, but upon a distinct developement of its principles, and the actual application of these to the purposes of which they are susceptible of being applied. In this point of view, none of the predecessors of Newton or Leibnits can come in competition with them; and, without examining the merits of their respective claims, we must still consider them as dividing exclusively the honour of the greatest discovery that has ever been made by human ingenuity.

Fermat wrote dissertations on the following subjects: 1. A Method for the Quadrature of Parabolas; 2. Another on Maxima and Minima; 3. An Introduction to Geometrical Loci; 4. A Treatise on Spherical Tangencies; 5. A Restoration of the two Books of Apollonius on Plane Loci; 6. A general Method for the Dimension of Curve Lines. His *Opera varia Mathematica*, printed at Toulouse in folio, 1679, contain also several smaller tracts, and a great number of letters to learned men. (A)

FERMENTATION, an intestine commotion, to which certain substances of vegetable or animal origin are, more or less, liable, from the spontaneous reaction of their constituent elements. The process embraces a series of changes of composition, and terminates in the formation of new products, which differ essentially from the original substance, as well as from one another. Fermentation is accordingly divided into three kinds; and to these, epithets have been applied descriptive of the products to which it gives birth, namely, the *vinous*, the *acetous*, and the *putrefactive*. After making some remarks upon the process in general, we shall consider the subject under these three heads.

It appears that no species of fermentation can take place without some portion of moisture, and a certain elevation of temperature. The presence of moisture is necessary, because no chemical action can be displayed by solids, without the intervention of water, to give mobility to their component particles, and allow them to exert their mutual attractions for each other; and hence, vegetable or animal substances which are well dried, and kept free from moisture, may be preserved for many years without suffering any material change n their composition. The degrees of heat necessary for fermentation vary with the different kinds of it; but below a certain temperature, the process does not commence under any form, or is effectually checked if t has already begun. Boerhaave imagined that the hree kinds of fermentation which we have enumerated, always succeeded each other in the same invariable order; but though this is often the case, it by no means holds universally. Many substances undergo the aceous, without having previously passed through the vinous fermentation; and a still greater number run into putrefaction that never suffer any change analogous to the vinous or acetous processes.

Fermentation.

Vinous fermentation—Whether the process be entirely confined to saccharine matter.

The vinous fermentation has been examined by chemists with a good deal of attention; and a variety of useful facts connected with the process have been noticed, though the circumstances that may be deemed essential to it are still involved in some degree of uncertainty. It is well known that saccharine matter, in some form or other, passes most readily into the vinous state, and that the product of the fermentation is strongest when the substance which is subjected to the process contains the largest portion of sugar; but it has not been decidedly ascertained whether sugar is the only substance capable of being converted into ardent spirit. When nutritive grains are employed to afford fermented liquors, they are previously exposed, at least in part, to the operation of malting, the object of which is to convert the farinaceous part into sugar by germination. This operation was long held indispensibly necessary to render the grain capable of the vinous fermentation; but experience has proved this opinion to be, in some measure, a mistake. Spirit distillers have of late been in the practice of malting only part of the grain, and adding the rest in a mashed or ground state; and they have found it to answer their purpose extremely well, when the latter is used in a greater proportion than the former. It is not a little singular, that when the farinaceous part of the mashed grain is mixed with water, it passes into the state of an acid, without acquiring any vinous quality; but when mixed with a quantity of saccharine matter, it undergoes the vinous fermentation, and yields a larger portion of spirit than the sweet matter alone would have afforded: a fact which seems to indicate, that the matter already in the state of sugar has the property of acting upon the farinaceous part of the grain, and converting it into a similar substance. Mr Irvine remarks, that "were it not for this property of the farina, great loss would frequently be sustained by the farmers in unfavourable seasons; as grain that has once begun to grow, and whose vegetation has been stopped, can never be made to grow again. Such grain never can undergo any farther malting: when grain has been made to grow in this manner, it can hardly be supposed that the change into saccharine matter is perfect or complete. It therefore would be less proper for the vinous fermentation, and would furnish a smaller quantity of spirit than grain which had been perfectly malted. This grain, however, when mixed with a quantity of perfect malt, and fermented, furnishes as much spirit as if the whole had been in the state of malt. The persons in this trade even prefer it to an equal quantity of malt; for in good seasons, when no such half-malted grain can be got, they take good grain, reduce it to meal, and mix it with their malt, and are satisfied that they obtain more spirits in this way, than from an equal quantity of good malt."

Spoiled grain not unfit for the use of the distiller.

Other substances beside saccharine matter necessary for the vinous fermentation.

Though sugar, in some modified form, appears to be the only substance capable of the vinous fermentation, certain other substances are necessary, both for the commencement and continuation of the process. A suitable quantity of water must be added to the saccharine matter: if the quantity, however, be in excess, the liquor is apt to pass into the acetous fermentation; and if it be too little, the process goes on difficultly and slowly. When the liquor to be fermented consists of a solution of pure sugar, a quantity of yeast is also necessary to excite the fermentation, and make it pass into the vinous state. Nor is the influence of temperature less essential: below 50° of Fahrenheit's scale the vinous fermentation proceeds very slowly; and at the freezing point it is completely checked. Above 70° the process advances too rapidly, and unless it be duly moderated, is apt to pass into the acetous stage.

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* *Theorie Analytique des Probabilites.*

Nature of the fermentative principle, or yeast.

The nature and action of yeast have been the subject of chemical investigation. Lavoisier ascertained, that, besides the other elements which are usually found in vegetables, it contained a quantity of nitrogen in its composition, and so far evinced a connection with animalized matter. The researches of Fabroni, Thenard, and Seguin have demonstrated that the fermenting property of yeast is owing to the presence of a substance resembling gluten or albumen, which is derived from certain vegetable infusions, capable of spontaneous fermentation.

Phenomena of the vinous fermentation.

When circumstances are sufficiently favourable for the vinous fermentation, the liquor, in passing into it, becomes somewhat turbid, and manifests a kind of commotion throughout its whole mass. Air bubbles begin to be separated, and being entangled by the flocculent part of the liquid, occasion a frothy appearance on the surface. In the meantime, the temperature gradually increases, and sometimes requires to be checked. The gas which is disengaged is found to consist chiefly of carbonic acid, mixed occasionally with a portion of hydrogen. At length, the extrication of air, and the intestine commotion with which it is accompanied, gradually diminish, and the process terminates by the liquor recovering its transparency. If the fermented substance be now examined, it is found to have exchanged its sweet taste for one of considerable pungency, and to have acquired the property of acting as a powerful stimulant on the animal system.

The presence of air, not essential.

The vinous fermentation depending in a great measure upon the separation of carbon, the process may be conducted without the aid of atmospheric air; and, indeed, it has been found by experiment, that, if the air be excluded, while the gas disengaged by the fermentation is permitted to make its escape, the vinous product is stronger than when the process is carried on in open vessels. In that case, however, as Chaptal remarks, the fermentation advances more slowly.

Products of the vinous fermentation.

The products to which the vinous fermentation gives birth, resemble one another by possessing an intoxicating quality, and yielding, by distillation, a portion of alcohol; but they differ considerably in their strength, odour and flavour. Their differences, in these respects, are owing, partly to the essential oils, and other proximate principles which they derive from the substances submitted to the vinous process, and partly to the manner of conducting the fermentation. They may be considered as of two general descriptions: Wines, properly so called, and the various kinds of ale or beer.

Various kinds of wine.

Wines are obtained by subjecting to fermentation the sweet juices of fruits, particularly that of the grape. The products are extremely diversified, and vary in flavour and appearance with the climate, soil, and the nature and culture of the vine, as well as with the manner of carrying on the fermentative process. Hence wines are sweetish, and weaker or stronger, according as the saccharine matter of the grape is more or less abundant, and the fermentation more or less complete; and they are sharp and sparkling, when part of the carbonic acid, which is generated during the process, is retained. Astringent wines derive their peculiar flavour from the astringent principle contained in the grape from which they are formed. The colour is communicated by the external pellicle of the fruit, and might easily be prevented, if necessary, by removing the husks, before fermentation. Wines of every description contain a certain portion of supertartrate of potash, which gradually separates from them, when they are left undisturbed; and to this is owing, in a great degree, the improvement of wines by age.

French wines.

France produces a great variety of excellent wines. For daily use, Fourcroy prefers those of Burgundy, because all their principles are duly combined, and none of them predominates, so as to communicate a peculiarity of flavour. The wines of Orleans, after being matured by age, resemble those of Burgundy. The red wines of Champagne are highly prized for their excellence and delicacy; though, in some cases, they possess a pungent and sourish taste, from being bottled before the carbonic acid is sufficiently disengaged by fermentation. The wines of Languedoc and Guienne are greatly esteemed, on account of their tonic qualities, particularly when they are mellowed by age. Those of Anjou are strong, spirituous, and intoxicating.

German, Italian, Spanish, and Portuguese wines.

The Rhenish and Moselle wines have a cool, sharp taste, and readily intoxicate. Some Italian wines, such as those of Orviette, Vicenza, and Lacryma Christi, are well fermented, and resemble the French wines. Those of Spain are in general boiled, sweet, and being but partially fermented, cannot be reckoned wholesome. The wines of Rota and Alicant must, however, be excepted, and are justly considered as useful stomachics. The wines of Portugal have been long in great demand in this country; and, indeed, no wine can be accounted superior to good old port.

Inferior kinds of wine.

The wines formed from other fruits, as currants, gooseberries, apples, pears, &c. are greatly inferior to those obtained from the grape. The juices of these fruits abound too much with acid, and too little with saccharine matter, to afford of themselves even tolerable wines; and they must, therefore, be improved by the addition of sugar, before fermentation. The wines from the juices of the apple and pear, denominated *cyder* and *perry*, contain a large portion of the acids of these fruits, and a considerable quantity of carbonic acid: to the presence of the latter is owing their sharpness and sparkling property. Cherries furnish a very pleasant wine; apricots, peaches, and prunes, afford wines of an indifferent quality.

Process of making ale or beer.

The nutritive grains, and particularly barley, furnish a fermented liquor of a vinous nature, called ale or beer. The grain, after being converted into malt, is first reduced to a coarse powder in a mill, or bruised between rollers. It is then infused in hot water, at the temperature of about 160° or 170°, and allowed to macerate for a few hours; after which the liquor is drawn off, and a fresh quantity of water is added. The infusion thus obtained, is denominated *wort*. Before being allowed to ferment, the wort is boiled with some bitter vegetable substance, commonly hops; partly with a view of correcting any ascescent tendency, and partly of improving the flavour of the liquor. To promote fermentation, a quantity of yeast is added to the infusion, after it has been allowed to cool; but the process is usually checked before it has been completely finished, and the liquor is then drawn off. When the object of the fermentation is to obtain a wort for distillation, part of the grain, as we formerly observed, is used in a raw or unmalted state. The process, in that case, is conducted more rapidly, and allowed to proceed to its utmost extent. See Brewing.

Theories of the vinous fermentation.

With respect to the theory of the chemical changes upon which the vinous fermentation depends, we have still no very precise knowledge. The subject was investigated by Lavoisier; but though he was the first who gave any thing like an accurate account of the process, the conclusions which he deduced from his experiments, are by no means free from objections. He dissolved a quantity of pure sugar in water, and caused the solution to ferment by the addition of yeast. The products were the carbonic acid gas disengaged during the process, and the alcohol remaining after its termination; and having previously determined sugar to be a compound of oxygen, hydrogen, and carbon, he inferred, that as no portion of the water of the fermenting liquor suffered decomposition, part of the oxygen and carbon of the sugar must have united to form carbonic acid, while the remaining part of these elements combined with the hydrogen, and produced alcohol. In this explanation, the operation of the yeast is entirely disregarded; and it seems to be taken for granted, that during the fermentation that substance suffers no change whatever, a circumstance which is by no means probable.

Lavoisier's theory.

Thenard's theory.

According to Thenard, the yeast excites fermentation by its carbon abstracting from the saccharine matter part of its oxygen, and thus forming at least a portion of the carbonic acid disengaged during the process; while the remaining elements of the sugar enter into combination with the hydrogen and nitrogen of the ferment, and produce the vinous liquor. From some experiments which he instituted with the view of supporting this opinion, he found, that the nitrogen of the yeast disappeared during the fermentation. He ascertained that it did not make its escape along with the carbonic acid, and he therefore inferred, that it must have entered into composition with the vinous product, though he did not succeed in detecting it by any mode of analysis.

guin's ory.

Seguin has proposed a theory of fermentation which differs considerably from that of Thenard. He is of opinion, that during the process water suffers decomposition; and that its oxygen combines with the carbonaceous part of the yeast to form carbonic acid, while its hydrogen unites with the saccharine matter, and produces the fermented liquor. To this theory it may be objected, that, besides being liable to the difficulty of accounting for the great quantity of carbonic acid extricated by referring it entirely to the carbon of the ferment, a greater weight of alcohol ought to be procured by fermentation than that of the sugar subjected to the process; which is contrary to experience, as little more than half the quantity is obtained. To this it may be added, that alcohol contains less oxygen than sugar. Upon the whole, the hypothesis of Seguin is perhaps less probable than that of Thenard; though in the present state of our knowledge on this subject, it would be easy to suggest various other theories of equal plausibility.

ous fer-ntation.

When the immediate products of the vinous fermentation are left exposed to the air, even at the ordinary temperatures of the atmosphere, they undergo another change, and are converted, by degrees, into an acid liquor. This forms the second stage of the general process of fermentation; and is termed *acetous*, because it produces acetous acid or vinegar. This species of fermentation commences immediately after the vinous stage is completed; and more especially if the fermentative principle has been used in excess. Hence, after the termination of the latter, the fermentation is usually stopped by decanting the clear wine from the lees, clarifying it with isinglass, corking it up carefully, and placing it in a cool situation where it may remain undisturbed. By these processes, the yeast, which may still exist in excess in the vinous product, is almost entirely removed, and thus the fermented liquor is not exposed to any decomposition from the reaction of its own elements.

Substances susceptible of the process.

The acetous fermentation is not confined to the products of the vinous stage; for it appears, that some substances not susceptible of vinous fermentation, as fecula and mucilage, have an ascescent tendency; but the bodies which have passed through that process, as wines, cider, beer, &c. are most susceptible of spontaneous acetification, and the richest and most generous wines furnish the best and strongest vinegar.

The vinous liquors do not readily undergo the acetous fermentation without the assistance of some fermentative principle; and hence, on converting wines into vinegar, a quantity of that substance, in some form or other, is usually added. It is in this way that the lees of vinegar, and casks impregnated with it, decide and promote acetification.

The presence of air necessary.

The presence of air is no less necessary to the acetous fermentation. Wines well corked in bottles, and grapes properly closed up in casks, may be preserved a very long time without suffering much change; but if the air be imperfectly excluded, they are gradually rendered sourish, and that, in a greater degree, the more freely the air is admitted. Saussure states, that in this case the oxygen of the air enters into combination with the carbon of the vinous liquor, and abstracts that element from it in the form of carbonic acid. It is probable, however, that a portion of it also combines with the same substance, and contributes to the production of the acetic acid which is formed.

Temperature best suited to the process.

The acetous fermentation goes on when the temperature is below 60°, but it is then slow; and experience has proved, that the process advances best when the temperature is between 70° and 75° of Fahrenheit's scale. In manufactories for making vinegar, the heat is kept up at this pitch by artificial means, when the temperature of the air is too low.

Effects of agitation.

A slight agitation, repeated at intervals, is extremely favourable to acetification. For this reason, cellars which are exposed to the continual shaking produced by any powerful mechanical instrument, or to the tremulous motion excited by the frequent rolling of heavy carriages, are very unfit for preserving vinous liquors. By the agitation to which wine is in such cases exposed, the tartar, the lees, the extractive principle, and all the other substances which it deposits in a state of rest, being kept suspended, operate incessantly as so many ferments, and prevent the depuration which might otherwise take place. Hence the acetous fermentation is greatly promoted by frequently stirring the liquor exposed to its action.

Phenomena attending the acetous fermentation.

The general appearances which present themselves in the acetous fermentation, differ but little from those in the vinous. A tremulous movement pervades the whole mass; but this is attended with a less copious disengagement of carbonic acid than in the vinous stage of the process. The temperature rises, and if the quantity of liquor be considerable, sometimes reaches 90° of Fahrenheit's scale. In the mean time a kind of filaments or streaks are moving continually in the heart of the fermenting mass; these divide, reunite, and at last deposit themselves on the sides and bottom of the vessel. When all these phenomena have ceased, the liquor gradually recovers its transparency, and is found to be converted into vinegar.

Theories of the acetous fermentation.

We shall now make a few observations on the theory of the process, though on this head we can offer nothing very precise or satisfactory. According to Lavoisier, "the spirituous part of the wine, which consists of carbon and hydrogen, is oxygenated and converted into vinegar. This operation, he adds, can only take place with free access of air, and is always attended with a diminution of the air employed, in consequence of the absorption of oxygen." This explanation is too general to be satisfactory; and it does not at all bring into view the action of the ferment. Chaptal has given a theory of the process, which is less exceptionable. "The hydrogen and the carbon, says he, exist in alcohol, and in the extractive principle of vegetables; but hydrogen predominates in the former, and carbon in the latter; so that if we oxygenate them separately, alcohol would furnish plenty of water, and very little acetic acid. The extractive principle would furnish plenty of carbonic acid, and a little acetic acid. But when the two principles are united, and they are oxygenated by any process whatever, water and carbonic acid are then produced, which bring the two principles into the proportions proper for forming the acetic acid."

Putrefactive fermentation.

The vinous and acetous fermentation are confined to a very few substances, chiefly of a saccharine nature: the putrefactive stage embraces a wider field, and takes place in almost every body of a vegetable or animal nature. The vegetable matters which undergo putrefaction most readily, are soluble in water; though those which are but imperfectly soluble, if kept in a moist state, are not exempted from this species of decomposition. This process is promoted by the same circumstances which are favourable to the others, namely, moisture, and elevation of temperature. The presence of air, also, has no less influence on the putrefactive, than on the acetous stage.

Nature of the process.

The elastic fluids which are evolved from vegetables during the putrefactive fermentation, are combinations of the elements of the vegetable substance, and have for their bases hydrogen and carbon. When the decomposition takes place under water, the hydrogen, by its greater tendency to elasticity, makes its escape, and the residual matter consists almost entirely of carbon. Hence wood, which has been long buried in the beds of rivers, is reduced nearly to the state of charcoal. If the carbonaceous part, however, be exposed to the air, it undergoes a gradual change, and is at last entirely decomposed, by being converted into carbonic acid.

Putrefaction of animal bodies.

When animal matters suffer putrefaction, they evolve, besides the usual elements of vegetables, a quantity of ammonia. They yield also certain other products which are more peculiar to them, particularly combinations of sulphur and phosphorus; and to these substances must be ascribed, the fetid odour and noxious properties of the gases, which are extricated from them during putrefaction.

Animal bodies scarcely suffer any change when they are well dried, and completely excluded from the air. Even in the warmer climates, beef, which has been effectually freed from its juices, may be preserved a long time without salt; and meat, which has been sufficiently roasted, and afterwards covered with melted suet, may be preserved in that state perfectly untainted for several months. Animals enveloped in ice, have been preserved for ages without suffering any change. It appears, also, that animal bodies powerfully resist putrefaction, which have been buried in morasses of peat; probably because, in such places, the carbonaceous part of the woody matter being converted into a substance resembling tan, produces upon the animal matter the usual effects of that vegetable product. See Chaptal's *Chemistry*, vol. iv. p. 510; Murray's *Chemistry*, vol. iv. p. 387; Fourcroy's *Chemistry*, vol. ii. p. 302. (A)

FERMOY is a handsome and flourishing market-town of Ireland, in the county of Cork. It is situated upon the river Blackwater, over which there is a good bridge. The town is regularly built, and contains several elegant public buildings, viz. a handsome church, a large school house, a market house, a sessions house which serves both for a theatre and an assembly room, a large barrack capable of accommodating two regiments of infantry, and another for cavalry on the opposite side of the river. There are here two good inns, an extensive porter brewery, a flour mill, a woollen manufactory, and a bank. About thirty years ago, this place was a miserable village, and it has been brought into its present state by John Anderson, Esq. a wealthy and public-spirited individual, to whom Ireland owes many other obligations. Land in the neighbourhood lets at from 3½ to 5 guineas per acre. Distance from Dublin 107 Irish miles, and from Cork 17 miles. (*j*)

FERNS. See FILICES.

Situation and coast.

FERNANDEZ, or JUAN FERNANDEZ, is the name of two islands in the Pacific Ocean, opposite to the western coast of South America, and about 32 leagues distant from each other. One of them, as lying farther off towards the west, is distinguished by the epithet De Afuera; and the other, as being nearer the land, is called De Tierra. It is to the latter, that the name of Juan Fernandes properly applies, an appellation which it is supposed to have received from a Spaniard of that name, who resided upon it for some time, and afterwards removed to the continent. It is situated in 33° 40′ S. Lat. and 79° W. Long. 110 leagues west from the coast of Chili; and about 440 to the north of Cape Horn. It is of an irregular form, and is surrounded by a very steep shore, about five leagues in length from north-west to south-east, and only two in breadth. There are three harbours and bays in the island; but two of these, one on the west and another on the east side, are very much exposed, and have only about fourteen fathoms of water. The third, which is the largest, and is called Cumberland Bay, lies on the north-east coast; but the depth of the water, which is forty or fifty fathoms within half a cable's length of the shore, the badness of the ground, which is a tenacious mud, mixed with shells and gravel, and the want of protection from the north-east winds, render the anchorage extremely dangerous. The only security, though not always sufficient, is to sail up to the farthest part of the bay, and to moor with one anchor in the water, and another on the south-west shore. At a distance, the whole island appears like one entire rock, and is for the most part very high land. In the northern quarter, the mountains are very lofty, steep, rugged, and almost inaccessible; but it slopes away towards the south point, where a remarkable islet, or large detached rock, appears about half a mile from the main land. Upon approaching the coast, very deep and romantic vallies are perceived, intersecting the most mountainous districts, shaded with different kinds of trees, and covered with the richest verdure. The air is generally mild and se-

Harbours.

Genera
pect.

Clim

rene. The heat of summer is moderate; the winter, which is never severe, lasts only during the months of June and July; and there is little thunder or tempestuous weather at any season. Fresh water is not very abundant, but several streams fall from the higher grounds, the water of which is said to be remarkably light, useful for creating an appetite, and among other medicinal qualities, very efficacious in removing indigestion. Copious dews at night, supply the want of rain, and preserve the trees and herbage in continual verdure. The land in the vallies, and on the acclivities of the lower hills, is a black fertile mould, capable by cultivation of producing grain and roots in abundance; but, towards the south-west, where the country is low and flat, the soil is loose, dry, and stony. The vallies and northern sides of the mountains are covered with trees; but the piercing violence of the south winds prevents their growth on the declivities in that direction. These trees are of various sorts, but chiefly aromatics, and many of them afford excellent timber. The myrtles are said to be the largest, and to be capable of yielding planks 40 feet in length. The pimento and the cabbage tree are found in some places, but none of the American fruit trees, which grow naturally in the forests. Every part of the island is covered with a sort of grass or straw, like the stalk of oats, which grows to the height of a man; and there is a great variety of esculent vegetables, especially antiscorbutics, such as purslane, water cresses, wild sorrel, turnips, and Swedish radishes.

The whole coasts of the island swarm with sea-wolves, or sea-lions, as the largest are sometimes called, on account of their having a mane on their necks. By the Spaniards they are commonly named *Lobos de Aceyte*, or oil-wolves; because of the vast quantity of fat or blubber of which their enormous body consists, makes them appear, when they move, like a skin full of oil. Vast shoals of fish also frequent the shores, particularly cod of a large size, very similar to that of Newfoundland; and the finest lobsters, often half a yard in length, may be taken in great abundance. The only quadrupeds found on the island are goats, the original breed of which had been set on shore by Juan Fernandes, and soon became so numerous, as to furnish an excellent supply of provisions to the navigators of these seas. This and other advantages, which the island afforded for refitting, victualling, wooding, and watering, rendered it the principal resort of the Buccaneers, and other cruizers in those quarters; and, in order to deprive them of the supplies which it afforded, the Spanish government sent a number of dogs, particularly grey hounds, for the purpose of exterminating the goats. Great numbers still remain in the steep places of the mountains, where the dogs are unable to pursue them; but where they are equally inaccessible to the pirates or the privateers. It has been observed of these dogs, that they never bark till they are brought together with others of their species; when they begin to imitate them in a strange manner, as if learning a new acquirement. No venomous creatures, or beasts of prey, or any other quadruped except these goats and dogs, have been observed on the island.

On this island Alexander Selkirk resided from the year 1705 to 1709; and from his history, Daniel Defoe is understood to have composed the interesting adventures of Robinson Crusoe. In this place also, in 1741, Lord Anson recruited the health of his crew, when they were so debilitated by the scurvy, and exhausted by the storms which they had encountered, as to be scarcely able to muster strength sufficient to heave the anchor. In 1766, the Spaniards formed a settlement, and established a garrison on the island. In the year following, Captain Carteret, in the course of his voyage round the world, attempted to enter Cumberland-bay, and was surprised to find it in the possession of the Spaniards. He neither anchored, nor had any communication with the shore; but was able to observe a number of men upon the beach, a house, and four pieces of cannon near the water side, a fort upon a rising ground about 300 yards farther from the sea, faced with stone, provided with 18 or 20 embrazures, with the Spanish colours flying on the top of it. There were 20 or 30 houses of different kinds scattered around it, a number of cattle feeding on the brow of the hills, and several spots enclosed for cultivation. Since that period no accounts respecting this settlement were laid before the public, as all access to its shores was invariably denied to strangers. But in 1792, Lieutenant John Moss of the royal navy, then commanding the ship William, employed on the southern whale and seal fishery, visited both the islands of Fernandez; and from his MS. the following notices were first published in the *Athenæum* for 1807. He was not aware of its having been occupied by the Spaniards, and went in his boat to look for a safe anchorage and to catch fish. Upon finding the place inhabited, he landed, and applied to the governor for leave to anchor and fish. Neither of his requests was formally granted; but getting into a position where none of the guns could bear on the boat, he caught as many fish as served the whole ship's company. Several months afterwards, however, touching a second time at Juan Fernandez, he obtained from the governor, Don Juan Calvo de la Canteza, free permission to supply the wants of his crew. The town, or village, is pleasantly situated in a fine valley between two high hills. A battery of five guns is placed round the west point of the harbour, and commands the road. It is built entirely of loose stones, piled up breast high, and formed into embrazures; but on the left of the valley, on a little eminence, another battery was then constructing of masonry, which had two faces with fourteen embrazures in each, one face pointing to the anchorage, and the other flanking the village. Two small guns also have been conveyed by a serpentine path to the top of the western hill. The whole force on the island, however, according to the report of the commandant, consisted only of six soldiers, and forty of the settlers armed and trained. There are about forty houses in the town, and several others in different parts of the island. Every house has a garden, with arbours of grape vines; and figs, cherries, plumbs, and almonds, appeared in a green state. There was abundance also of potatoes, cabbages, onions, thyme, and other vegetables; but none of them in perfection, as a kind of grub is said, in a great measure, to destroy the kitchen gardens. Great numbers of goats were seen on the sides of every hill. The dress of the women is of a singular description, and was stated by the governor to be the same as that of the ladies of Chili and Peru. They wear a petticoat which reaches only a little below the knee, and which is spread out by a hoop at the bottom to a great distance round them, leaving the legs entirely exposed, which are, however, covered by drawers. They wear long hair, plaited into forty or fifty small braids, hanging straight down the back. In every house that Captain Moss entered, the women presented him with *maté*, the infusion of the herb of Paraguay, which is sucked up through a pipe or tube, handed

Fernandez de Afuera.

from one person to another. The women were, in general, handsome, and every house swarmed with children. Thus there was a prospect of the colony increasing rapidly in population; but it was lately stated in some of the public prints, that the Spaniards had withdrawn the whole of the garrison and settlers; so that Juan Fernandez, with all its advantages, is probably again abandoned to its original uninhabited and uncultivated state. (*q*)

FERNANDEZ de Afuera, lies in 33° 41′ South Latitude, and 81° 40′ West Longitude; and as both islands are situated so directly in the same latitude, strangers are apt to mistake the one for the other; but they may be easily distinguished by the obvious circumstance of the land in De Afuera being highest towards the south, while the more elevated part of De Tierra is towards the north; and at the south point also of the latter is a large rock, or islet, about half a mile from the island. Fernandez de Afuera is generally named Masafuero by the English navigators, which is probably nothing more than a corruption of the Spanish appellation *Mas-afuera*, which expresses its being more remote than the other from the American continent. It is very high and mountainous, appearing at a distance like one hill or rock, and in clear weather may be seen from Fernandes de Tierra. It is of a triangular form, and about eight leagues in circumference. Its cliffs on the south end are almost perpendicular from the sea; but on the opposite side, though the land is likewise very elevated, is a fine low green point stretching northward from the bottom of the cliff, and forming a perfect level, fully a mile and a half in length. In the account of Lord Anson's voyage, there is said to be no proper anchorage except on the north side, in deep water; but Commodore Byron found good anchorage on the east side towards the south point, in twenty fathoms, within two cables length of the shore. Captain Carteret also says, that he saw no part where there was not anchorage; that on the western side particularly, there is anchorage about a mile from the shore in twenty fathom, and about two miles and a half in forty fathom, with a fine black sand at the bottom; and mentions a remarkable rock with a hole in it, on the south-west point, as a good mark for anchoring on that side. Captain Moss, however, affirms that in no part is there good anchorage; that in the places where an anchor may be let go, there is foul ground; and that nothing but great distress can warrant anchoring on the coast of this island. All the navigators who have visited it, concur in their descriptions of the extreme difficulty of landing, on account of the high surf, which breaks upon large fragments of rocks all round the island, so that a boat cannot safely come within a cable's length of the shore. The only mode of landing is by swimming from the boat, and then mooring her without the rocks; and Commodore Byron, in order to protect his men from being bruised by the rocks, as well as to assist them in swimming, provided them with cork jackets. Neither is there any other way of getting off the wood and water casks, but by hauling them to the boat with ropes; and even this is sometimes found to be impracticable. When three of Captain Carteret's crew had swam ashore for the purpose of procuring water, the surf rose so high that they could not return to the boat, and were left all night in a state of complete nakedness on the island during a violent storm of rain, thunder, and lightning. In order to protect themselves from the cold, they lay upon one another, each man placing himself alternately between the other two; and next day, by travelling along the shore, and occasionally swimming around the steep points, reached with difficulty the tent of their shipmates in another part of the island. In addition to these dangers, the men, in swimming ashore, are exposed to attacks from enormous sharks of the most ravenous kind, which were observed by Byron's crew to dart into the very surf after the swimmers. The boats of Captain Moss were staved in one of his attempts to land; and he advises the ships which go there for seals, to have a strong built boat for the purpose of anchoring behind the surf. He found only one place, which he named Enderby's Cove, where a boat could be hauled up in a small inlet on the east side; but that only when the wind is from south-west to north-north-west. "There are many places, however," Captain Carteret observes, "where it would be very easy to make a commodious landing, by building a wharf, which it would be worth while even for a single ship to do, if she was to continue any time at the island." It affords all the requisite refreshments for voyagers, especially in the summer season; and would be a very desirable place to touch at, were the landing rendered more easy. There is plenty of wood and water all round the island; but the east side has the most pleasant aspect, shewing numerous vallies covered with trees, rich in verdure, and abounding in flowers of the lily and violet kinds. Down every valley runs a copious stream of water, which expands in its descent among the rocks into several successive reservoirs; but the seals go far up into these vallies, and the water has a bad taste, unless taken above the places which they frequent. These animals are so numerous on this island, that they literally cover the shores; and Captain Moss's crew took 2100 of them in a few days. There are various kinds of fish also, particularly cod, halibut, coal-fish, and cray fish, in such abundance that in two hours a single boat with hooks and lines might take sufficient to serve a large ship's company for two days. They are all excellent in their kind, and many of them weigh from twenty to thirty pounds. There are many goats in the place, which are not difficult to be caught, and which Byron compares to the best venison in England. Among the birds, were observed particularly various kinds of hawks, some very large, and others as small as a goldfinch; and the pintado birds were so numerous, that in one night during a gale, Carteret's people caught not less than seven hundred, which flew straight into the fire which they had kindled on shore. Among the vegetables, the mountain cabbage was particularly noticed; and the trees consisted principally of red cedar, and a hard yellow wood like box. See Byron's *Voyage round the World;* Carteret's *Voyage round the World*; Ulloa's *Voyage to South America*, vol. ii. p. 219; and *Extracts from* Captain Moss's MS. *first published in the Athenæum*, vol. i. p. 581. (*q*)

Fernandez, Fernando.

FERNANDO de Norona, is the name of an island in the Atlantic, about 60 or 80 leagues from the coast of Brasil. It is no where above two leagues in extent. Its surface is unequal and mountainous; and in the middle of the island is a mountain called *Campanario*, or the Belfry, from the resemblance of its summit to a church tower.

The island is, in general, very fertile, notwithstanding the reports of its sterility so industriously propagated by the Portuguese. It produces every species of grain and fruits common in hot climates; but, for the want of moisture, the crops are often destroyed. *Two or three years often pass without rain*, and excepting in some brooks, not a drop of water is to be found in the

d. When Ulloa visited the island, they had had ain for two years, but violent showers came on up- e 19th of May. The inhabitants save the water in resembling cisterns.

There is in the inland part of the island a Portuguese , in which reside a governor and the parish priest. When the Portuguese had compelled the French India Company to evacuate this island, they erect- seven elegant forts, in order to defend it. Three of se defend the north harbour, two the north-west, two the eastern part of the island, where there is a d bay fit only for barks. The forts are all built tone, are spacious, and are well garrisoned and ided with large artillery. Fort Remedios alone con- ed 1000 men, partly regulars, sent from Fernam- , who are relieved every six months, and partly icts from the opposite coast of Brazil.

he principal fort, called Fort Remedios, stands high steep rock washed by the sea, at the foot of ch is a cavern, where vast quantities of water are inually pouring in without any perceptible outlet. this place, dreadful eructations of the wind are d at short intervals, which being compressed, strug- for a vent against the torrent of the water, and by g the whole mouth of the cave in its ascent, leaves ge vacuity after its discharge, which is done with ise resembling that of a volcano; but neither on opposite side of the island, nor throughout its whole uit, is there any place or mark, which affords the room for conjecture with regard to the other ths of this cavern, so that it is supposed to be at a t distance from it in the sea."

here are two harbours capable of receiving ships of greatest burden, one on the north, and another on the h-west side of the island. The first is the best, both shelter, capacity, and the goodness of its bottom. h the harbours are exposed to the north and west, when these winds prevail they are both imprac- ble, the ships being in danger, and all communica- with the shore totally precluded by the agitation violence of the surface. Even in easterly winds it angerous to attempt a landing.

he harbours or roads abound in fish of five or six erent species, among which are lampreys and more- of an enormous size. Between the months of De- ber and April, when the turtles lay their eggs, the res of the whole island are covered with them: they n retire into the sea, and disappear.

he inhabitants of all ranks subsist chiefly upon the ina di pari, or wood meal, obtained from the roots ed Moniato, Nane, and Yuca. It is little more than dust, both with regard to taste and smell. The po- n of the island, according to solar observations, is th Lat. 3° 56′ 20″, and West Long. 32° 37′ 45″. See a's *Voyage to South America*, book ix. chap. iii. Cook's *Second Voyage*. (*w*)

EROE Isles. See Faroe.

ERRARA, a duchy situated in the eastern part of per Italy, and part of the pontifical domains. This itory is nearly of a triangular shape; one side tches 25 miles along the shores of the Adriatic on east, another about 58 miles to the north, and the d runs about 67 miles to the west and south, where bounded by the duchies of Mantua, Mirandola, Modena, as also the provinces of Bologna and Ro- gna; and elsewhere by the Venetian states. The face is in general level eastward from the river Po, ich is here navigable, and divides in two branches, ed Po di Volano, and Po di Primaro, both flowing into the Adriatic, and each having a harbour at its mouth. Besides these, it is fertilized by the streams Panaro, Reno, Tartaro, and numerous artificial canals. Only one of the preceding harbours belongs to Ferrara; the other is a subject of frequent controversy between it and the neighbouring territories.

Ferrara.

This duchy contains three cities; Ferrara, the capital, which we shall afterwards describe more particularly; Commacchio, and Cento. Commacchio occupies a situation in the midst of a considerable extent of low marshy ground, called the Commacchian Marshes, defended by a high alluvial bulwark from the sea, but penetrated by a canal, at the extremity of which is Porta Magnavacca. These marshes are not less than between 70 and 80 miles in circuit, and communicate with a salt lagoon, celebrated for the quality of its fishes. Cento is surrounded by an earthen rampart and ditch. It was the place of the nativity of Guercino, a famous painter. Besides these cities, there are 18 towns with their own peculiar and exclusive jurisdiction, and 162 parochial villages. We are not acquainted with any recent census, but, 30 years ago, the total population of the Ferrarese territory amounted to 235,234 souls.

The principal products of this duchy consist in grain, fruit, and wine; abundance of flax and hemp, some silk and wool; and it is said that horses and cattle are here of the best description. But there is no conspicuous activity in carrying on agricultural operations, nor any demonstrations of commercial enterprize. In common with the other territories of an ecclesiastical government, the people are passive and languid in their undertakings. Revenues, nevertheless, arise from imports and exports; from the fisheries of Commacchio, which are very profitable; from salt-works, and other sources. There cannot be much trade in a territory of such extent, when an annual fair, in a town called Luga, is considered as a remarkable event.

Ferrara being part of the papal domain, is governed by a cardinal, who is sent to the chief city every three years as legate a latere; and there is at the same time appointed a dignified prelate, with the title of vice-legate, who rules in his absence. The detail of civil and criminal matters, is committed to the cognisance of certain judges appointed by the Pope; and there is besides a senate, or grand council of 100 persons, chosen from the nobles, merchants, and citizens, renewed every three years; from which ten persons of each order are selected, to constitute an annual magistracy. In respect to its ecclesiastical state, the duchy is divided into nine dioceses, at the head of which is an archbishop, generally a cardinal, endowed with ample revenues, and possessing a jurisdiction over 135 parishes. There are sixty monasteries of different orders, containing 1350 monks and priests; ten convents, containing about 620 nuns; and three hospitals, in which 50 boys are maintained, but it does not appear whether these are of a religious or a civil institution.

The duchy of Ferrara is said to have been recognised very anciently as an important territory. It was a sovereign and independent state under the dominion of its own dukes, of the family of Este, who began to govern in the year 1205, and subsisted several centuries. On the death of Alphonso the Second in October 1597, Pope Clement VIII. declared the duchy had devolved to the papal see, and he took possession of it in person. Along with the other Italian provinces, it became implicated in the consequences of the French revolution. It was ceded by the Roman pontiff in 1797 to the government of France, and by it constituted the department of the Lower Po; but by the recent restitution of the Pope, it has again become an integral part of the territories of the apostolic chamber. (*c*)

FERRARA, a city of Italy, the capital of the duchy of Ferrara, situated on the north bank of the river Po, which here divides into two branches, called Po di Volano and Po di Primaro, both flowing to the east. This city is surrounded by a fortified wall and broad ditch, which may be filled with water by means of a canal from the river. There are five gates, called the gate of St Benedict, St Paul, St George, St John the Baptist, and the gate of the Angels; and at the south-west extremity there is a regular fortress. Within the walls are some gardens, which enlarge the dimensions ascribed to the city. There are several squares, and the streets are tolerably wide and convenient. The suburbs of St Luke and St George are without the walls, on the opposite side of the river, which is crossed by bridges near two of the gates.

The principal objects in the city of Ferrara, are churches, convents, a few edifices for public purposes not ecclesiastical, and those belonging to private individuals; but of the first there is a very great superiority with regard to numbers. The metropolitan church, dedicated to St George, the tutelar saint of the city, occupies one side the Piazza di San Crispino, the principal square. The antiquity of this edifice remounts to the year 1135, when it was completed and consecrated, and exhibits a specimen of the bad taste which pervaded the architecture of that period, intermixed with subsequent alterations. It contains many monuments, inscriptions, and statues. Among the last, are five in bronze as large as life, ornamenting an altar, representing the crucifixion, the Virgin Mary, and other sanctified persons. There are several of fine Carrara marble, of which one of the most conspicuous, and as large as life, was erected by the citizens of Ferrara, in honour of Albert their sovereign lord, in 1393, who had repaired to the Pope with a great cavalcade, and obtained two important bulls, sanctioning the erection of a university, and certain privileges regarding succession to property. Pope Urban III. having died in Ferrara in the year 1187, was interred here, and his successor Gregory VIII. elected in the church. The architecture of the tower, which was built in 1412, and consists of marble, is much celebrated.

About the year 1506, a spacious edifice, the church of St Benedict, was built by two native architects towards the western part of the city, to which a monastery adjoins. Here are deposited the remains of the famous Italian poet Ariosto, in a marble mausoleum, executed by Nano, a Mantuan sculptor, with two inscriptions, one of which was composed by Guarini. This monument has attracted the notice of crowned heads in their visits to Italy, while the ashes of philosophers have reposed in neglected obscurity. Ariosto was a native of Ferrara, and his house is still shown as a curiosity to strangers. It bears two inscriptions, composed by himself and his natural son, a literary ecclesiastic: The former is in these words, *Parva, sed apta mihi, sed nulli obnoxia, sed non sordida, parta meo sed tamen aere domus*, certainly neither very elegant nor poetical; the latter is, *Sic domus hæc Areosta propitios habeat deos olim ut Pindarioa.* The house was built by him, and he died there on the sixth of June 1533. In the monastery annexed to the church of St Benedict, are preserved some important archives.

A church dedicated to St Francis was founded at an early period of the Ferrarese history, and after being frequently renewed and altered, was at last completed in the year 1495. This edifice is also rich in pictures and statues, and presents several beautiful sculptures of different descriptions. It is besides remarkable for an echo which father Lana, in his work *Magisterium Naturæ et Artis*, considers one of the most wonderful phenomena extant. The voice of a person standing in a particular position, near the main entrance, is repeated 15 or 16 times distinctly, and afterwards more faintly, for some intervals, until totally lost. The repetitions are so numerous, however, that, to avoid confusion, only a single syllable must be expressed, in order that the echo may be heard in perfection.

The church of St Dominic, a spacious modern edifice, with a monastery of Dominican monks connected with it, stands towards the south-west part of the city. It was founded in the year 1710, and completed in 1726, but the Dominicans had an establishment as early as 1235. Like the former, the church has many pictures; and Celio Calcagnini, a celebrated scholar of Ferrara, bequeathed a valuable library to the convent, in the 16th century.

Besides these religious edifices, there are many more in this city worthy of attention: the total number of churches and chapels amounts to 60 or 70, independent of convents for monks and nuns. The inquisition has also a tribunal here; and the archbishop a palace adjacent to the metropolitan church. It is a modern building, commenced in 1718; it has some statues, and a staircase which is much admired.

Not far from the last of these buildings stands a great square edifice, with towers at each angle, ornamented by a balustrade, which is called the castle, and is occupied by the cardinal legate. This was originally designed as a place of security, and erected by one of the lords of Ferrara, after quelling a popular tumult. A military guard is mounted here, and the grand council assembles in a large hall devoted to that purpose.

There are two foundling hospitals for male and female children, one for orphans, and a poor's house for mendicants; also different public buildings for the administration of justice, one of which, called the palace of reason, was erected in the year 1326. The theatre is a modern structure of Ionic architecture, erected in 1786, by Joseph Campana, a Ferrarese.

Pope Clement VIII. after taking possession of the duchy, resolved to build a fort, including a large portion of the city, and several churches; but the present structure, which is of a pentagonal form, was founded only in the year 1608. It is entered by a fine marble gateway, erected in 1630, and there is a colossal statue of Pope Paul V. in marble, under whose pontificate the fortress was completed. A small garrison was lately kept in it.

Ferrara is said to have been distinguished by its literati at a very ancient period, and we have already remarked that the foundation of a university was authorised in 1391. The seminary which now appears, however, is of more modern date, having either been built or altered in 1610. It is rather a plain structure with a handsome gateway, surmounted by a tower and cupola, and stands towards the south part of the city. To judge by the extent of the literary establishment, this should be a favoured place for study, but we believe that although famous of old, it has now lost much of its celebrity. The whole consists of 22 chairs embracing the principal branches of science, an anatomical theatre, a school for the fine arts, a museum of antiquities, and a botanical garden. In sculptures, cameos, coins, inscriptions, and mosaic work, the collection is

Ferro, Ferrol.

said to be considerable; but it has most probably shared in the dilapidations which have lately diminished the curiosities of Italy.

The library of the university is of more recent institution, having been commenced by the purchase of that of Cardinal Bentivoglio, in 1748. The library of the college of the Jesuits was added some time after, and it was opened for public use in 1750. Here there is a collection of the writings of nearly 500 Ferrarese literati, contained in 1300 volumes. Among the manuscripts are some of Ariosto's poems, written in his own hand. This library possesses 13,000 drawings and engravings, several subjects in natural history, and models in clay.

Many celebrated characters owe their birth to Ferrara, famed for poetry, history, science, and the arts; but at this day the city does not enjoy its ancient reputation; and the successive changes of government have contributed to lessen the confidence of the inhabitants.

We are not aware of any accurate census later than one made in 1784, when the population amounted to 31,253. Its position, according to the trigonometrical observations of Boscovich, is East Long. 11° 36′ 25″, and North Lat. 44° 49′ 56″. See Sardi *Historie Ferrarese.* Bononi *De situ, aquis et aere Ferrariæ.* Barotti *Memorie istoriche de letterati Ferrarese. Compendio istorico delle Chiese di Ferrara.* Frizzi, *Guida del Forastieri per la Citta di Ferrara.* (c)

FERRO, or Hierro, the name of the most westerly of the Canary Isles, is about 15 miles broad, and 45 in circuit. The coast is very precipitous and difficult of ascent, but the summit is level and fertile. Ferro was formerly the meridian from which the English and French reckoned their longitude. Its longitude, according to the most correct astronomical observation, is 17° 9′ 45″, and North Latitude 27° 47′ 0″. For a full account of the history and statistics of this and the other islands, see Canary Isles. (j)

FERROL is one of the best sea-port towns of Spain, in the province of Galicia. It is situated to the north-north-east of Corunna, and ten leagues from Cape Ortegal. Before 1752, Ferrol was merely a fishing village, but a large town, containing many elegant public buildings, has been erected on a regular plan. The school for midshipmen is a magnificent edifice. The arsenal is deemed the handsomest in the kingdom, and there is an extensive rope-walk, and a machine for hammering the copper for sheathing vessels. There are also two hospitals, one for the inhabitants, and another for the navy and army. The harbour is extremely safe, and is on all sides protected from winds. Its position is very strong, being surrounded with redoubts, mounting five cannon on each front, and four on each side, and the whole is connected with an entrenchment and a parapet which mask the interior works. All ships that go from the harbour into the sea must, for the distance of a league, file off one by one, and pass along a shore defended by forts, and which, in case of need, may be obstructed with piles, while, on the land side, it may be easily defended in the event of a disembarkation. It would be almost impossible to besiege the town regularly. Trenches could not be opened on account of the nature of the soil, and it would be equally difficult to force the entrance of the harbour, as it is lined with strong batteries, the mole itself being well provided with heavy artillery. The bason for the fleet is very large. Every ship has a separate warehouse, where all its tackle, &c. is marked and deposited. All the work in the harbour is carried on by 600 galley slaves, who compose the presidario. The approach to the coast between Corunna and Ferrol is defended by two castles, viz. that of St Philip and Palma. No expence, indeed, has been spared by the Spanish government to render Ferrol one of the most complete naval establishments in the world. There is here a military commandant, a governor, an intendant, and a numerous staff. All foreign ships are excluded from Ferrol, only coasting vessels and Spanish ships which bring articles of necessity being admitted. Sea and river fish are caught in abundance; and in the vicinity of the town there are numerous fountains of excellent water. Ferrol contains but one manufactory, which is for sail-cloth.

Feu

The town contains only one parish, and a convent of the Seraphic order. The population is about 8000, excepting in time of war, when it exceeds this number considerably. The position of Ferrol, according to the most accurate sidereal observations, is in West Long. 8° 15′, and North Lat. 43° 29′. See Laborde's *View of Spain*, vol. ii. p. 441. (π)

FEU, or Fee, (*feudum* or *foodum*, Fr. *fief*), a word of uncertain derivation, sometimes denotes an estate held by feudal tenure, but is more properly used to denote the right resulting to the vassal from the feudal contract. In this latter acceptation it may be defined a gratuitous right to the property of lands, under the condition of fealty and military service to be performed to the superior, who grants the right, by the vassal, who obtains it. The interest which the superior retains to himself, or rather the law reserves for him, in all feudal grants, is called *dominium directum*, because it is the highest and most eminent right; that which the vassal acquires goes under the name of *dominium utile*, being subordinate to the other, and the most profitable of the two, since the vassal enjoys the whole fruits of the subject.

Although, from the nature of the feudal constitution, feus were originally granted solely in consideration of military services, yet services of a mere civil or religious nature were early substituted in their room, at the pleasure of the superior. And in the course of time, the spirit of the original system was so far left out of view, that services of all kinds were entirely dispensed with in some feudal tenures; but, in such cases, the vassal, who is exempted from services, must be liable in the payment either of a yearly sum of money, or a quantity of grain, or something else, however inconsiderable, merely as an acknowledgment of the superior's right.

Fees have been divided, with reference to the sources from which they flow, into *feuda ligia* and *non ligia*. A liege-fee is that granted by a sovereign, to whom the vassal owes absolute fidelity, without exception. *Feuda non ligia*, on the other hand, are those derived from subjects superiors, in which a reservation is always implied with respect to the fealty or allegiance which is due to the highest or liege lord. By the written feudal usages, feus are divided into *antiqua* and *nova*. The former are such as come by succession; the latter such as are acquired by gift, purchase, or other singular title.

Some things are considered as essential to the constitution of a feu; some are natural to it, and others only accidental. No feu can subsist without its essential characters; and, upon the least alteration made in these, the right must resolve into one of another kind. Such essential requisites are the reservation of the right of superiority, and the acknowledgment of this right on the part of the vassal, by some service or payment. By the *naturalia feudi*, is understood whatever arises from the nature of the contract, and is therefore deemed part of it, although not expressly provided. These, however, may receive an alteration from the will of the parties, without destroying the feudal contract. The *accidentalia feudi* depend entirely on the convention of parties, and are never presumed, but must be the subject of express stipulation. See the *Consuetudines Feudorum*; the books of *Regiam Magistatem*; Craig, *De Feudis*; Erskine's *Inst. of the Law of Scotland*, b. ii. t. 3. (z)

FEUDAL, is a term used to denote that system of legal polity, in regard to tenures of land, which was generally introduced, at an early period, among the states of modern Europe.

The origin of the feudal system is involved in considerable obscurity. Some writers pretend to have discovered traces of it among the Romans; while others have attempted to deduce its origin from the usages of the ancient Germans and Gauls. But in referring to the early history of Europe, we shall be enabled to trace it, in a more natural and satisfactory manner, to the policy of those migratory German nations, who overrun the provinces of the Roman empire, and established themselves in the conquered territory. Among these, the Longobards, or Lombards, are generally believed to have laid the foundation, or, at least, to have made the earliest improvements of the modern feudal system. That tribe, having early left their original seats in the northern parts of Germany, after many migrations, seized upon upper Italy, and established the kingdom of Lombardy, about the year 568. In order to enable them to secure their conquests, they found it expedient to divide the conquered country among their chief captains, reserving the superiority to their king; and these captains, after retaining what they deemed sufficient for themselves, parcelled out the remainder among a lower rank of officers, under the condition of fidelity and military service. The policy of this system was so universally approved of in that military age, that even after the overthrow of the monarchy of the Lombards in Italy, it was adopted by Charlemagne, and eventually by most of the princes of Europe. It was introduced into England by William the Conqueror, who, with the view of keeping his English subjects under complete subjection, divided all the lands of England, with very few exceptions, into baronies, which he distributed, according to the feudal plan, among the most considerable of his Norman adventurers.

The period of its introduction into Scotland is uncertain. It must be observed, however, that the word *Feudum* is not to be found, either in the laws of the Lombards, or even in the constitutions of Charlemagne, in all of which *beneficium* is the term uniformly employed to express a feudal grant.

Feudal grants were originally precarious, being revocable at the pleasure of the granter; but afterwards they were generally conferred for life. During this period, however, the feudal institution may be considered as in its infancy. In a short time, the son of the feudatory was permitted to succeed to his father; and the Emperor Conrad II. surnamed the *Salic*, in order to engage his vassals more effectually to his interest, in an expedition which he undertook to Italy, in the year 1086, extended feudal succession to grandsons, and even, in the collateral line, to brothers, in the case of a *feudum antiquum*. This celebrated constitution paved the way for the hereditary descent of feudal tenures.

The feudal law had early received considerable improvements from the numerous constitutions, both of the Lombard kings, and of Charlemagne and his successors; yet its principles were but little known, as these constitutions were not for some time collected into one body. In order to obviate this inconvenience, the Emperor Frederick, surnamed Barbarossa, directed an institute of the feudal system and usages to be compiled, about the year 1170, which was entitled *Consuetudines Feudorum*, and is subjoined to Justinian's novels, in almost all the editions of the *Corpus juris civilis*.

This collection, in so far as it is the work of private hands, does not appear to have been expressly confirmed by the authority of any of the German emperors. But it is generally understood to have had their approbation, and was accounted the customary feudal law of all the countries subject to the empire, with a few exceptions in favour of particular usages in certain cities and districts. But the authority of those written usages has not been acknowledged by any other state; every kingdom having received the institution with peculiar modifications, and formed for itself such a scheme of feudal laws as best accorded with its own particular constitution. (z)

FEVER. See MEDICINE.

FEZ, or FAS, the capital of the ancient kingdom of that name in Western Barbary, was founded about the 185th year of the Hegira (A. D. 786,) by Idris a descendent of Mahomet, who had fled from Medina to avoid the persecution of the Caliph Abd Allah. It is situated on gently rising grounds at the bottom of a valley, watered by the river Rasalema; but the centre of the town lies very low, and in the winter season is wet and dirty, and at all times rather unhealthy. It consists of two divisions, the new town, called Fez Jedide, and the Old Fez el Bâlee. The former was founded about the end of the 13th century, when the kingdom of Fez was united with Morocco under the sovereigns of the Marin dynasty. It is a well built town, in an elevated and healthy situation, surrounded by a double wall, and contains the citadel where the governor has his residence, a large palace, a magnificent mosque, and the greater part of the machinery employed by the different trades. Its gardens are particularly delightful, abounding in all sorts of delicious fruits and odoriferous flowers. Old Fez has been highly celebrated for its ancient splendour; and is said to have contained 62 market places, 86 public fountains, 200 streets, 600 mosques, and 200 bridges over canals and branches of the river. Though now greatly reduced, it is still the most celebrated city in West Barbary; and though less extensive than the metropolis of Morocco, it is full of finer houses, and contains a greater number of inhabitants. The houses are spacious and lofty; and have flat roofs ingeniously worked in wood, and covered with terrace. There the inhabitants recline upon their carpets in summer, to enjoy the cool breeze of the evening; and a small turret, containing one or two rooms, is erected for the females of the family. The portals are supported by pillars of brick, covered with plaster; and, in the centre of each house, is an open square surrounded by a gallery, which communicates with the stair-case, and into which the doors of the different apartments open. These doors are wide and lofty, made of curiously carved wood, painted with various colours; and the beams of the roofs are also whimsically and gaily painted in the Arabesque style. Every house is supplied with water from the river, which enters the town by covered channels; and the principal dwellings have private baths and cisterns. A bath is attached to every mosque, for religious ablutions, and there are public baths in various parts of the town to which the people resort, the men at one hour, and the women at another. There is a great number of mosques, sanctuaries, and other public buildings; and about fifty of these are very sumptuous edifices, ornamented with a kind of marble procured in the Atlas mountains, and unknown in the countries of Europe. A few professors and students are maintained in the mosques, and the rich Moors send their children thither for their education; but their studies are chiefly confined to the explanation of the Koran, and the principal advantage is the purity of the Arabic spoken in the city. The mosque, called Carubin, is one of the most ancient and magnificent edifices in the empire of Morocco, and perhaps in all Africa; but has not been found to correspond with the glowing description by Leo Africanus. There are a very few of those hospitals mentioned by early writers, where there is indeed no physicians in attendance, but where the poor are supplied with food, and the sick are attended by women. Among these is a madhouse, where the lunatics are chained down in apartments, which are disgustingly filthy, and treated in a very harsh manner. The caravanseras or inns, are very numerous, amounting nearly to 200. They are three stories high, and contain from 50 to 100 apartments, each of which is provided with a mat and a water cock. The traveller pays so much a day for his room, but brings his own bedding, and purchases and dresses his own provisions. Each trade and article of merchandize has its separate department; and there is a large square place divided into twelve wards, which are filled chiefly with silk cloth and linen shops, provided with sixty criers or itinerant auctioneers, who go about with the different pieces in their hands, crying, "who bids more?" and sell the lot to the highest bidder. The inhabitants of Fez rear a great deal of poultry, which they keep in cages to prevent them runing about the house. No animals are permitted to be slaughtered in the city, but are killed at a distance near to the river; and, after the price has been fixed by the officer, who superintends the price of provisions, is sent to the shops in the town. There are many corn mills in the city, where the poorer sort buy the flour in small quantities, and where the richer inhabitants send their own corn to be ground. The population of the old and new towns is estimated at 380,000; and the people, though more polished than the other Moors, are remarkable for their bigotted spirit. "If a Christian," says Jackson, "were there to exclaim, Allah k'beer, 'God is great,' he would be invited immediately to add to it, 'and Mohammed is his prophet,' which, if he were inadvertently to utter before witnesses, he would be irretrievably made a Mohammedan, and circumcised accordingly." They were in former times still more infamous, on account of their licentious manners; and debauchery was even encouraged by the government as a source of revenue: but at present the state of morals is not worse than in the other cities of the empire.

When the Mahometans of Andalusia, Granada, and Cordova, during the revolutions in Spain, passed over to Fez, they introduced the Spanish method of dressing and dyeing sheep and goat skins, red and yellow, then called Cordovan, now Morocco leather. At Fez, also, was first established the manufacture of milled woollen caps worn by the Moors, and brought to so great perfection at Tunis. They are named *Fez* by the Turks, which confirms the account of their having originated in that city. Besides gauzes, silks, and other stuffs fabricated at this city, it is celebrated for an elegant manufacture, namely, sashes of silk and gold. In addition to its own manufactures, Fez is the common magazine of Barbary, to which are brought all kinds of commodities from the sea-ports of Morocco and the Mediterranean, from the eastern countries by the caravans of pilgrims, and from the centre of Africa by the caravans of merchants. Its chief exports are almonds, gums, raisins, dates, carraway, anise and worm seeds, citrons, capers, oil of olives, tallow, hides, tanned leather, particularly Morocco leather, ostrich feathers, lead ore, elephant's teeth. To Timbuctoo, the merchants of Fez send various articles of European, Indian, and Barbary produce, especially linens, muslins, fine cloths, raw silk, beads, brass nails, coffee, tea, and sugar, shawls, and sashes of silk and gold, haiks (pieces of cloth used by the Africans as outer garments) of silk, cotton, and wool; turbans, spices, tobacco, and salt. In return, they receive gums, gold rings, elephant's teeth, ambergris, ostrich feathers, and slaves. The caravans, which carry on this trade from Fez to Timbuctoo across the desert, generally travel seven hours a-day at the rate of 3½ miles an hour, and complete the journey between the two cities in 129 days, 54 only of which are employed in actual travelling.

On account of the number of Mahometan saints said to have been buried in Fez, it is considered by the Moors as a sacred asylum, and an object of devotion. Hence all Jews and Christians are prohibited from entering its gates; and an order from the emperor is necessary before they can gain admission. This, however, seems to apply only to Old Fez, for the new town is principally occupied by Jews, who, notwithstanding the contempt with which they are treated, carry on a regular trade with the inhabitants of the city. In the various revolutions to which the country of West Barbary has been subject, the citizens of Fez were always ready to change their master, and generally yielded at the first approach of a victorious leader. They pretend even to plead, that this is a privilege which they enjoy from the founder of their city; but it is considered as proceeding rather from their own cowardice, or from the situation of the place, which is incapable of defence. Old Fez is several leagues in circumference, but a great part of the inclosed space is occupied by gardens. It is about 120 miles from the sea-coast, and 36 from the city of Mequinez, to which there is an excellent road along a pleasant plain, watered by numerous rivulets and canals. The communication between these two cities is very easy and expeditious, by means of mules, which may be had ready saddled at all hours of the day, and which accomplish the journey at an easy pace in six hours, so as frequently to return the same day.

In the year 1799, a dreadful plague, which spread over all the empire of Morocco, originated in this city; which some ascribed to infected merchandise from the East, and others to the pestilential smell of the dead locusts which infested West Barbary during the seven preceding years. In the cities of Old and New Fez, it carried off 1200 or 1500 persons daily; and during its continuance, 65,000 of the inhabitants perished. This deadly calamity produced a wonderful alteration in the circumstances of the survivors, and reduced all classes to a strange system of equality. Flocks and herds were left in the fields without a possessor; fortunes were inherited, or rather taken up, by common labourers; provisions became extremely cheap and abundant; the expence of labour increased enormously; and so few of the poor were spared, or those who had survived were now become so rich, that there were none almost to work or serve; and the most wealthy individuals were obliged to labour for themselves, and to perform with their own hands the menial offices of their respective families. See *Modern Univ. Hist.* vol. xviii. p. 74; Chenier's *Present State of Morocco*, vol. i. p. 71; and Jackson's *Account of Morocco*, p. 129. (*q*)

FEZ, a province of the empire of Morocco, is bounded on the north by the province of Errif, on the east by Tedla, on the south by the mountains of Atlas, on the south-west by Shawiya, and on the west by Garb and Benchassan. Its dependencies are very extensive, and include several mountainous tracts, well cultivated, and full of inhabitants. **Mountains.** Its principal mountains are Zaragh, one side of which is covered with vines, while the other is completely barren, and which lies between the river Seboo and the plain where the capital stands; and Zarkon or Zaraharum, which is shaded with olive trees, and on the summit of which are the ruins of Titulies or Tuilit, once a considerable town, but demolished by a prince of the family of the Almoravides. **Rivers.** The Seboo, one of the largest rivers of West Barbary, rises in the eastern part of the province near the foot of the Atlas mountains, and passes within six miles of the city of Fez. It is impassable, except in boats and rafts; and at Mamora, where it enters the ocean, is a deep and navigable river, capable of affording a cheap conveyance for corn to the city of Fez, which is at present supplied with that essential article by means of loaded camels, whose hire often exceeds the original cost of the grain. The river Bu Regreg, also, which discharges itself into the ocean between the towns of Salee and Rabat, rises on one of the mountains of Atlas, and proceeds through the woods and vallies of the territory of Fez. **Towns.** The only other town in the province, of any note, besides the capital, is MEQUINEZ, which will be described in a separate article. **Soil and cultivation.** The whole of this province is a rich champaign country, remarkably productive in grain. The soil is a rich black, sometimes reddish mould, without stones or clay. No other manure is employed, than the long stubble burned on the field; and no other culture is necessary than to throw the grain upon the ground, and cover it with the plough. **Productions.** The principal crops are wheat and barley; but in lands adjacent to the rivers, beans, pease, caravanies, rice, and Indian corn, are occasionally cultivated. There are few trees, except the olive plantations and gardens around the cities of Fez and Mequinez. Fruits of various kinds are very abundant, particularly oranges, (which are frequently sold at a dollar a thousand,) grapes, melons, and figs of different sorts. Cherries also are produced in this province, though they are said not to ripen in any other part of the empire. In the country around the city of Mequinez, as well as in the province of Benihassan, is produced the tobacco called Mequinasi, which is so much esteemed for making snuff. A mineral salt of a red colour, exceedingly strong, is dug from quarries in the vicinity of Fez; and considerable quantities of saltpetre are also produced in the adjoining country. Near to the city is a mineral spring, which is said to be an infallible remedy for the venereal disease, if used for forty days successively; and many persons in all stages of the disorder, resort to its waters with much advantage. On the western side of the plain of Fez, is a village containing the sanctuary of Sidi Idris, the founder and first sovereign of Fez; and this asylum, to which malefactors frequently betake themselves, is never violated by the emperor, or any other authority in his dominions. The country part of this province is inhabited altogether by Arabs, except a small tribe of Berebbers. See Jackson's *Account of Morocco*, p. 13; Chenier's *Present State of Morocco*, vol. i.; *Modern Univ. Hist.* vol. xviii; and Playfair's *Geography*, vol. vi. (*q*)

FEZ, formerly a distinct kingdom, and the first established Mahometan sovereignty in West Barbary, contained seven provinces, viz. Fez, El Garb, Errif, Benihassan, Temsena, Shawiya, and Tedla. The first of these has been described above; and the rest will be found under the article MOROCCO, with which they are now united as one empire. Of that empire, in short, the kingdom of Fez forms the northern division, and is separated from it by the river Morbeya on the south. It is bounded on the east by Algiers, and on the north and west by the sea. It is inhabited chiefly by Arabs, who dwell in tents, and are divided into various tribes; but the mountainous districts of Atlas are occupied by Berebbers. The kingdom of Fez owes its origin to Sidi Idris, a descendant of Mahomet, who fled into Mauritania about the end of the eighth century, to avoid the persecuting sword of the Caliph Abd-Allah. He first settled at Tuilit, in the mountain of Zaaron, or Zerone, between Fez and Mequinez, where he spread the religion of Mahomet, and acquired by his virtues so great influence among the natives, that they became desirous to live under his government, as well as to adopt his religious creed. According to some authors, it was the son of this person, named also Idris, who founded the city, and established the monarchy of Fez, which was for a long time called by the Mahometans the court or kingdom of the West. The descendants of this prince continued to reign about 150 years; but during the tenth century great divisions began to prevail, and crowds of usurpers arose in the west of Barbary. The tribe of Zenetes, called Mequinesi, seized upon several provinces, and founded the city of Mequinez, within ten leagues of the capital. A marabout of that tribe, having by fanatical predictions seduced the minds of the people from the family of Idris, formed a considerable party in the province of Temsena, and marched against the king of Fez, who was thus forced to acknowledge the authority of the Zenetes at Mequinez. Another of these innovators, who professed to be a descendant of Ali and Fatima, proclaimed himself El-Mohadi, or pontiff of the Mussulmans, and accused the house of Idris of following a heretical sect. He succeeded in expelling the princes of that family from their governments;* and having declared himself Caliph, he marched towards Mount Atlas to extend his dominions. While he was thus engaged in the South, Al-Habed Almonsor, one of the generals of the king of Cordova, arrived with an army to aid the house of Idris; and, having conquered a part of the kingdom of Fez, garrisoned the city of Arzilla, which remained for some time under the government of the Moors in Spain. El-Mohade, by this diminution of his power, and by the hatred

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* One of these princes named Shariff El Idrissi, was the author of the work entitled *Geographia Nubiensis*, which he dedicated to Roger king of Sicily, to whose court he had fled for protection.

cited by his cruelties, was unable to retain
authority in Fez, and was obliged to pass
ern part of Africa. The whole of northern
at this time, torn by divisions, in conse-
tradition, that, 300 years after Mahomet,
ector of the faithful should come from the
ous impostors, profiting by this belief, at-
seize the supreme power, and were suc-
placed by new pretenders. About the
e eleventh century, Abu Tessifin, chief of
hoons, or Morabites,† a tribe which origi-
neighbourhood of Tunis, traversed Mount
head of a numerous army, and took pos-
e city of Agmet. Here he fixed his resi-
extending his conquests northwards, pro-
self Emir El Mumenin, the chief of the
lis arms were constantly victorious; and,
s battles with the petty monarchs who held
t cities, he remained sovereign of Mauri-
founded the dynasty of the Morabites, or as
med by the Spanish writers the Almoravides.
cceeded in 1086 by his son Yusef, who
rather finished the city of Maroksh, or
which his father had begun; and there esta-
seat of his empire. A multitude of Zenetes,
un to propagate new errors and innovations
vince of Temsena, he sent several Morabites
people to their former tenets; but, instead
g to their reasonings and remonstrances, the
of the new doctrines put them all to death,
mbled at Anafai. Enraged by this inhuman
of his ambassadors, Yusef passed the Morbeya
werful army, and ravaged the country of the
with fire and sword. The Zenetes, unable to
progress, retreated towards Fez, demanding
its sovereign; but this prince, instead of af-
em protection, marched against them as in-
nd coming up with them on the banks of the
when they were harassed with hunger and
he cut the greater part of them to pieces.
ving rendered Temsena a complete desert, re-
ctorious to Morocco; but the desolated pro-
aving been repeopled by colonies from the
of Fez, he embraced the first opportunity of
g the king of that country. Having entered
tories of his neighbour with a numerous army,
ed a decisive victory over his forces, he de-
im of his kingdom, and united it to the em-
Morocco, about the end of the eleventh century.
rn *Univ. Hist.* vol. xviii.; Chenier's *Present
Morocco*, vol. ii.; Playfair's *Geography*, vol. vi.;
kson's *Account of Morocco*. (q)

ZAN, one of the provinces of the state of Tri-
a considerable tract of country in the interior
thern Africa, situated about 360 miles south of
ta, and nearly midway between Tunis and Egypt.
nsidered as the country of the ancient Gara-
, and as corresponding with the Phazania of
(lib. v. c. 5). As it is completely insulated by
or rocky tracts, and separated to a considerable
e from any other habitable district, it falls un-
e description of Oases, or fertile spots in the
of the desert, and may be reckoned the largest
that is known. It is a circular, or rather oval
n, surrounded on all sides by an irregular ridge
untains, except on the western border, where it communicates with the flat sandy desert, or Sahara.

Fezzan.

Extent and boundaries.

The greatest length of the cultivated part of the kingdom is about 300 English miles from north to south, and the greatest breadth 200 miles from east to west. But the mountainous regions of *Harutch*, on the eastern frontier, and other desert districts of considerable extent towards the south and west, are within its territory. On the north, it is bordered by Arab tribes, nominally dependent on Tripoli; on the east, by the hilly deserts already mentioned; on the south and south-east, by the country of the Tibboes; on the south-west, by that of the Nomadic Tuarics; and on the west by Arabs. Almost the only historical notices of this country by the ancients, are to be found in Pliny, who mentions it as one of the most important conquests of the Roman general Balbus.

Climate.

The climate is at no season temperate or agreeable. The heat is intense during summer; and when the wind blows from the south, is scarcely supportable, even by the natives. A bleak north wind prevails during winter, which produces a severe and chilling degree of cold. Rain very seldom falls through the whole year, and when it does come, is little in quantity; but water, notwithstanding, is found every where in wells of eight or ten feet in depth; a circumstance, supposed to be owing to the high lands by which the country is surrounded. Thunder and lightning are rare; but storms of wind, whirling up the sand and dust, are very frequent. There is not a river or stream of any note in the whole country, as far as was observed by Horneman; but Edrisi mentions a river of some size, which takes its course by Zuela, and which is lost in the sand before it reaches the sea. The soil is a deep sand, covering calcareous rock or earth, and sometimes a stratum of argillaceous substance; but, as the springs are so abundant, few regions in the north of Africa exhibit a richer vegetation.

Productions.

Both the soil and climate are well adapted for the growth of wheat and barley; but, from the indolence of the people, their ignorance of tillage, or the oppressions of their government, a sufficiency of corn for their subsistence is not raised in the country, and they depend upon importations from the Arab countries to the north. Pot-herb and garden vegetables in general are plentiful, and some senna is raised in the western districts; but the natural and staple produce of Fezzan is dates. There are few horses in the country, and camels are kept only by the wealthy inhabitants; but asses are generally used for all the purposes of burden, draught, or carriage. A few horned cattle are found in the fertile districts, which are employed in drawing water from the wells, and are never slaughtered for food unless in cases of extreme necessity. The ordinary domestic animal is the goat, and a few sheep are reared in the southern parts of the kingdom. The antelope, tiger, and ostrich, are the principal wild animals, from which the natives derive any benefit; but the more noxious and loathsome creatures are sufficiently abundant; and snakes, adders, scorpions, toads, and similar vermin, are the constant inhabitants of the fields, gardens, and houses.

Commerce.

Fezzan is the most advantageously situated, of all the inland countries in Africa, for the purposes of commerce, as it lies in the shortest and most convenient line of communication between the Mediterranean and the centre of Africa, as well as between Western

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he name is supposed to be derived from the word Marabout, a name given to Mahomedan Saints or Monks, and applied to the fol-
of Tessifin, because most of his officers were persons of that description.

Africa, Egypt, and Arabia. Its trade is, of consequence, considerable; and its inhabitants are the most enterprising merchants in that quarter of the globe; but their traffic consists chiefly in foreign merchandize, and they are enriched by the carrying trade across the deserts. The capital, Mourzouk, is the great resort of numerous caravans from Cairo, Bengasi, Gadames, Troat, and Soudan; and the rendezvous of all the Mahomedan pilgrims from the west and south of Africa on their way to Mecca. The caravans from the south and west bring, as articles of commerce, slaves of both sexes, ostrich feathers, tiger skins, zibette, and gold, partly in dust, and partly in native grains, to be manufactured into ornaments for the inhabitants of the interior. From Bornou, copper is imported in great quantities; from Cairo, silks, calicoes, cloths, and East India goods; tobacco, snuff, and Turkey ware from Bengasi; paper, fire-arms, sabres, red worsted caps, and woollen cloths, from Tripoli and Gadamer; and butter, oil, corn, senna, and camels, from the Tuarics and southern Arabs.

Manufactures.

There are no articles of manufacture produced in the country, and the natives discover no ingenuity as artificers. The only tradesmen are shoemakers and smiths; and the latter work every metal without distinction, so that the same person, who forges shoes for the sultan's horse, forms rings for the princesses. The women, indeed, make a coarse woollen cloth called *abbe*; but, so imperfect is their manufacturing skill, that the whole work is performed solely by the hand, and the woof is inserted into the warp thread by thread.

Government.

The country of Fezzan is governed by a Sultan, who reigns with unlimited authority over his subjects, but holds his dominions as tributary to the Bashaw of Tripoli. The crown is hereditary, but does not always descend from father to son. The law of succession requires, that, when a vacancy occurs, the oldest prince of the blood royal shall ascend the throne, a regulation which frequently occasions an appeal to the sword. The Sultan, by the rules of the state, must always be of the family of the Shereefs of Waden or Zuila. The palace is situated within the fortress of the capital, and the Sultan lives there retired, without any other inmates, except the eunuchs, who act as his attendants. The Harem is contiguous to the royal residence, and the females are brought to the apartment of the sovereign, who never enters their habitation. He never appears without the castle walls, except on Fridays, when he goes to the great mosque, or on other public festivals, when he is attended by his whole court. On these days of solemnity, he rides on horseback, in a plain on the outside of the town, where his courtiers exhibit their skill in equestrian exercises, or practise the art of shooting. On these days of state and ceremony, the Sultan's apparel consists of a large white stuff frock or shirt, made in the Soudan fashion, and brocaded with gold and silver. Under this covering, he wears the ordinary dress of the Tripolitans, without any thing remarkable in his appearance, except his turban, which extends a full yard from the front to the hinder part, and is not less than two thirds of a yard in breadth. His official attendants are the first and second ministers of state, both of whom must be freeborn men, but whose influence, notwithstanding their nominal rank, is very inconsiderable; the general of his forces, who may be appointed from any class at the sovereign's pleasure; a number of black slaves, who are purchased when boys, and educated for the court according to their talents; and a few white slaves, termed Mamelukes, who are mostly Europeans, Greeks, Genoese, or the descendants of such, and who possess the principal interest and power.

Administration of justice.

Justice is administered by an officer, named the Cadi, who is at the same time the chief of the clergy, and possesses great influence with the people. His decisions are directed by the Mahommedan law, and acknowledged customs; and, in his absence, his secretary or scribe performs the office of judge. In criminal cases, however, the judgment is arbitrary, or is referred to the Sultan. The dignity of chief justice is hereditary in a certain family; but the sultan selects the individual of that race who is most qualified by his learning to fill the office, or, in other words, who can best read or write. The princes of the sultan's family also claim a right of jurisdiction, and of imposing corporal punishments. Next to the cadi, as head of the clergy, is the great iman.

Revenues.

The public revenues arise from territorial domains of the crown, from the royal gardens and forests, from salt pools and natron lakes, from duties on foreign trade, from assessments on all gardens and cultivated lands, and from arbitrary fines or requisitions. The public expenditure consists in the maintenance of the sultan, his court and household. The princes of the royal family are supported by proportions of corn delivered weekly from the sultan's stores, by the proceeds of territory appropriated to that purpose, and by occasional exactions from the people, levied by their personal authority, and by their own slaves. The cadi, the great officers of the government, and the clergy, are maintained by the produce of date-tree woods and gardens, granted as temporary possessions to those who hold the respective offices.

Towns.

The kingdom of Fezzan contains 101 towns and villages, among which there are few places of any note, and still fewer whose positions are ascertained. The principal are *Mourzouk* the capital, frequently called Fezzan, which is situated nearly in the centre of the country, is a walled town, and contains many ruins of ancient buildings, amidst its cottages of earth and stone. *Zawila* or *Zuila*, supposed to be the *Cillaba* of Pliny, is about 70 miles eastward of Mourzouk, was once the capital of the kingdom, and is still a place of considerable importance in the country, as being the residence of many of the leading men, and of the relatives of the sovereign. Its environs are well watered, remarkable for fertility, full of groves of date-trees, and better cultivated than most other places. It contains many vestiges of ancient splendour, cisterns, vaulted caves, &c. which some writers consider as the remains of Roman architecture; but the ruins, which Mr Horneman observed, were entirely of Mahommedan origin. *Jerma, or Yerma*, unquestionably the *Garama* of the Romans, and the capital of the country at the time of its being subdued by their arms, is situated as far to the west as Zuila is to the east of Mourzouk, and is full of majestic ruins, and ancient inscriptions. *Temissa*, about 120 miles eastward of the capital, is rather a garrison than a town, built on a hill, and surrounded by a high wall; the inhabitants of which derive their chief subsistence from the date trees, and employ themselves in keeping sheep and goats. The ruins of this place are merely dilapidated houses, built of lime-stone, and cemented with a reddish mortar. *Katron*, or *Gatron*, about 60 miles south of Mourzeuk, is remarkable only for the multitude of common fowls reared by its inhabitants, and the abundant crops of Indian corn in its neighbourhood

Mendra, about 60 miles south-east of the capital, is an inconsiderable place, but the province, which bears its name, is remarkable for the quantity of trona, a species of fossil alkali, which floats on the surface of its numerous lakes. *Teghery*, about 70 miles south-west of the capital, is a small town, nearest to the western frontier. To the north are *Sockna*, *Sibha*, *Hun*, and *Waden*.

The population of Fezzan is calculated at 70,000 or 75,000 souls, all professing the Mahommedan religion. The genuine natives are described as a people of ordinary stature, deep brown complexion, black short hair, regular features, and feeble limbs. Their whole appearance and gesture is said to denote an utter want of energy either in mind or body, which is ascribed to the oppressive nature of their government, and to the extreme poverty of their diet, which consists chiefly of dates, and a kind of farinaceous pap, with sometimes, though rarely, a little rancid oil or fat. It is a common periphrasis to designate a rich man, by saying that he is one who eats bread and meat every day. But though remarkably abstemious in diet, they are greatly addicted to drunkenness. Their beverage is the juice of the date tree, called *lagibi*, which, when fresh, is sweet and pleasant, though apt to produce flatulency and di- ırrhœa, or a liquor prepared from the dates, called *busa*, which is extremely intoxicating. Their ordinary amuse- nent in their evening meetings, is drinking, with the ɔccasional addition of a dancing girl, whose musical in- strument is a rude kind of guitar, and whose motions re sufficiently lascivious. The manners of the females, n general, are unusually licentious, and they are vehe- ently fond of amusement, especially of dancing in the pen places of the towns and villages, at all hours of he day.

Their habitations are as wretched as their subsist- nce. They are all extremely low, with no other aper- ure for light than the door, and are built with stones r bricks of a calcareous earth mixed with clay, and ried in the sun. The walls are covered over with hite mortar; and the whole operations of building and astering, are performed without tools, entirely by the nds of the labourer.

The dress of the Fezzaners consists of a shirt or frock nerally blue, made of a coarse linen or cotton cloth, ought from Cairo; and the *abbe* of their own manu- cture. The richer class wear the Tripolitan habit, th a Soudan shirt over it of variegated pattern and lours. The ornaments of the women consists chief- in necklaces of glass beads, or pieces of agate with ound silver plate in the front, trinkets made of silver ls, coral and amber suspended from the tresses of r on the head, and rings of glass, horn, brass or er, to the number sometimes of nine or ten on each and leg.

he principal diseases of the natives, are a fever and e, which is particularly dangerous to foreigners; norrhoids or piles, which are supposed to be ag- rated by the immoderate use of red pepper; the ll-pox, in which an application of tamarinds and ns is said to be employed with good effect to pre- e the eyes; and the venereal disorder, with which natives are said to be infected only once in the se of their lives, and which they generally cure out much difficulty, by the use of salts and colo- tida, or powerful cathartics, washing the sores, at the time, with natron water or dissolved soda. Their cal art extends only to the setting of a simple fracture occasional blood-letting, which is always done by ing, and never by venesection; and their practice of medicine is confined almost entirely to amulets, consisting of sentences from the Koran, written on a slip of paper, which the patient wears about his neck, and is sometimes compelled to swallow. See Playfair's *Geography*, vol. vi.; Rennel's *Geography of Herodotus*, p. 566, 618; and Horneman's *Travels in Africa*, p. 62. (*q*)

FIARS, is the name given in Scotland to the average prices of different kinds of grain sold within the county for ready money. Their average prices are generally determined by the Sheriff in the end of February or the beginning of March, from the evidence of a number of respectable tenants or dealers in corn. The method of striking the average varies in different counties. (*w*)

FIBRE. See ANATOMY and PHYSIOLOGY.

FICHTELBERG. See FRANCONIA.

FIELDING, HENRY, the celebrated English novellist and dramatic writer, was born at Sharpham Park, near Glastonbury, in Somersetshire, on the 22d of April 1707. His father, Edmund Fielding, Esq. who was nearly related to many noble and respectable families, served in the wars under the Duke of Marlborough, and eventually rose to the rank of lieutenant-general. His mother was daughter to Judge Gould, and aunt to Sir Henry Gould, one of the Barons of Exchequer.

Fielding received the rudiments of his education at home, under the care of the Rev. Mr Oliver, a person for whom he seems to have entertained no very great regard, as he is generally thought to have designed the character of Parson Trulliber, in *Joseph Andrews*, as a portrait of this clergyman. He was afterwards removed to Eton school, where he had an opportunity of forming a very early intimacy with the first Lord Lyttleton, Mr Fox, (afterwards Lord Holland), Mr Pitt, (afterwards Earl of Chatham), Sir Charles Hanbury Williams, and several other distinguished characters, who ever afterwards cherished a warm regard for him. By an assiduous application to study, and the cultivation of strong natural talents, he is said to have also acquired an uncommon knowledge of the Greek and Latin classics, during his residence at that seminary of education; and when about eighteen years of age, he repaired to the University of Leyden, where he studied under the most celebrated civilians for about two years, at the expiration of which period, he was compelled, in consequence of the failure of remittances, to return to London.

His father, General Fielding, having greatly increased his family by a second marriage, found it impossible to afford his son an income proportionate to the expence attending those fashionable pleasures in which he had too great a propensity to indulge. The vivacity of his temper, the brilliancy of his wit, and his relish of all kinds of social enjoyment, made him a most desirable companion in the circles of literature and fashion; but having no disposition for economy, and his finances being inadequate to the draughts made upon him in this career of dissipation, he soon found himself involved in difficulties, from which, however, he hoped to extricate himself by the exertion of his genius. Accordingly, he commenced a writer for the stage, in 1727, when he had just completed his 20th year.

His first dramatic attempt was a comedy, called *Love in several Masques*, which met with a very favourable reception, although it laboured under the disadvantage of succeeding the long and crowded run of the *Pro-*

voked Husband. His second play, *The Temple Beau,* which came out in the following year, was also well received; and from this period, down to the year 1737, he continued to bring forward a number of plays and farces for the stage. But although these productions possess considerable merit, it is generally allowed that Fielding's genius did not qualify him to excel in dramatic writing. In his plays there is a good deal of humour and vivacity; considerable knowledge of life and manners, and abundant proof of an attentive observation of the humours, foibles, and affectations of mankind; but they were evidently written with carelessness and haste: he disregarded the rules of dramatic decorum, despised the criticism of the stage, and obstinately refused to make any sacrifice to the feelings or taste of his audience.

The emoluments which he derived from his dramatic labours were by no means great; and his imprudent extravagance still continuing, he found himself obliged to resort to some extraordinary expedient to supply his necessities. With this view, about the year 1735, he determined to bring forward a new, but certainly rather hazardous species of public entertainment; which is particularly worthy of notice, as it eventually produced an extraordinary change in the constitution of the dramatic system. He brought together a great number of actors, and made preparations for exhibiting performances, chiefly of a political tendency, at the little theatre in the Haymarket, under the whimsical title of *The Great Mogul's Company of Comedians.* It is probable, that, in this singular undertaking, Fielding was actuated, in some degree, by resentment against the minister, Sir Robert Walpole, whom he had formerly flattered, but who had hitherto neglected him. The project had the charm of novelty, and succeeded, at first, so well, as to answer his most sanguine expectations. But this novelty wore off with the first season; and the design afterwards received so little encouragement, that he was forced to abandon it. The severity of the satire, however, which was contained in the pieces represented at the Haymarket theatre, galled the minister extremely; and he determined, not only to put down this modern Aristophanes, but, like the Athenian government upon a similar occasion, to restrain the public theatres from becoming the scourge of statesmen at any future period. Accordingly, he laid hold of a piece, *written by somebody or other,* called the *Golden Rump,* which was full of abuse, not only against the parliament, the council, and the ministry, but even against majesty itself; and made such use of it, as occasioned the bringing into parliament a bill for the regulation of the theatre, and to explain an act made in the 12th year of the reign of Queen Anne, for reducing the laws concerning rogues, vagabonds, common players of interlude, &c. By this bill, which passed into a law, after some opposition, in the year 1737, the representation of dramatic performances was confined to Westminster and its liberties, or where the royal family should at any time reside; and the theatres were prohibited from bringing forward any play, or even prologue, epilogue, or song, without its being first inspected, and obtaining the licence of the Lord Chamberlain. This act also took from the crown the power of licensing any more theatres; and inflicted heavy penalties on those who should afterwards bring forward any performance, in defiance of the regulations of the statute.

Among the earlier publications of Fielding, may be noticed an *Essay on Conversation;* an essay on the *Knowledge of the Characters of Men;* a *Journey from this World to the next,* and the history of *Jonathan Wild the Great;* in which he displayed his natural humour and knowledge of mankind, but of which the moral tendency is, at least, questionable.

Some years after he began to write for the stage, he married Miss Craddock, a young lady from Salisbury, who possessed a great share of beauty, and a fortune of L. 1500 pounds; and about the same time, he succeeded, through his mother, to an estate at Stower, in Dorsetshire, of somewhat better than L. 200 *per annum.* With this fortune, he wisely determined to bid adieu to all the follies and dissipation, to which he had been hitherto addicted, and to retire, with his wife, to his seat in the country. But his natural disposition, and passion for society and show, unfortunately prevailed over all his prudent resolutions; and in less than three years from the period of his retirement from town, his extravagance, and total neglect of economy, reduced him to his former state of poverty, dependence and distress. His ardent temperament, however, did not suffer him to be easily discouraged. Having determined once more to exert his abilities, in endeavouring to procure a competent subsistence, he applied himself to the study of the law; and, after the usual period of probation at the Temple, being called to the bar, he made no inconsiderable figure in Westminster Hall. But the intemperance of his early life now began to affect his health so seriously, as to prevent him from bestowing the requisite attention on the duties of his laborious profession, and consequently from reaching that degree of eminence, which his talents and learning might otherwise have enabled him to attain. Amidst all the severities of pain and poverty, however, he still found resources in his genius. For some years he devoted his talents, in a great measure, to politics; he was concerned in a political periodical paper, called the *Champion,* which owed its principal support to his prolific pen; and he was himself the conductor of two publications,—the *True Patriot,* and the *Jacobite Journal,* in which he supported the principles of the Hanoverian succession. About this period, he had the misfortune to lose his wife, whom he had ever tenderly loved; and the fortitude which he had displayed in all the former distressing situations of his life, is said to have entirely deserted him upon this trying occasion. His grief, indeed, was so violent, that great apprehensions were, for a considerable period, entertained of his being ever again possessed of the ordinary powers of reason.

Hitherto the genius of Fielding had been chiefly employed upon hasty dramatic effusions, written, no doubt, with the view of supplying the exigencies of the moment; or upon miscellaneous subjects of mere temporary interest. But the powers of his mind were now, fortunately, directed to a species of composition, in which he was peculiarly qualified to excel, and to which he is principally indebted for his reputation with posterity. His celebrated novels of *Joseph Andrews, Tom Jones,* and *Amelia,* produced in the maturity of his genius, may be considered as forming a sort of æra in the history of his own life, as well as in the literary history of his country; and have elevated Fielding to the first rank among the writers of fictitious narratives.

But the employment of his pen could evidently afford him only a precarious subsistence; and although he occasionally received large contributions from his friends, he is said to have been frequently reduced, by disease and the pressure of want, to the extremity of distress.

In the year 1749, however, he at length received a small pension from government; and, at the same time, his necessities obliged him to accept of the office of an acting magistrate in the commission of the peace for Westminster and the county of Middlesex; an office which is generally obnoxious to the populace, and which, in those days, seldom failed to incur the imputation of venality and corruption, from which Fielding was not exempted. In discharging the duties of his office, he displayed uncommon vigilance and activity of mind. Besides suggesting many beneficial plans and regulations of police, he published several useful tracts upon subjects connected with the functions which he had to discharge. Among these are, *An Address to the Grand Jury of Middlesex*, which he delivered at Westminster in June 1749; *A Proposal for making an effectual provision for the Poor*, &c. *An Inquiry into the Causes of the late increase of Robbers*, &c.

The active and busy life of Fielding was now drawing towards a period. In 1753, his constitution had become so entirely shattered, in consequence of continual and severe attacks of gout and other disorders, that all remedies proved ineffectual; and, by the advice of his physicians, he at length determined to try the restorative effects of a warmer climate. In the following year, he accordingly set out for Lisbon; but in two months after his arrival at that place, death terminated his sufferings in the forty-eighth year of his age. He wrote a journal of the occurrences which happened to him during the voyage from England to Lisbon, which was published after his death. This work proves, that even in the last stage of bodily infirmity, his strong naural powers of intellect and observation had not deerted him.

Henry Fielding was tall in stature, and of a large nd robust frame of body, until the vigour of his contitution had been broken by disease. He had an ardent temperament, and lively passions. His affections were warm, sincere, and constant; and his conduct and deportment were open and manly. He possessed a vigorous understanding, a quick discernment, an invenive genius, and lively wit; and to considerable learnng, he added acute powers of observation, and an exensive knowledge of men and manners. But the turbulence of his passions occasionally hurried him beyond he bounds of moderation; and in the article of worldy prudence he appears to have been remarkably deficient. Although at one time possessed of a moderate estate, he suffered it to be devoured by an extravagant hospitality; and the whole course of his life exhibits a onstant struggle of genius with poverty and disease.

As an author, Fielding must be allowed to hold a very eminent rank. His dramatic pieces, indeed, alhough the production of no ordinary pen, are not onsidered as of first-rate excellence; but in the proince of novel-writing, he has no superior, and few quals. *Joseph Andrews* and *Tom Jones* are esteemed mong the most finished performances of this kind in ny language; and are too universally known to require any more particular notice in this work.

An edition of the works of Fielding, with an essay on his life and genius, by Mr Murphy, was published n London, in 1762, 4to. See also *The Life of Henry Fielding, Esq.* by William Watson, Edinburgh, 1807. z)

FIFESHIRE, the name of one of the maritime counies of Scotland.

1. *Natural History.*—The county of Fife is situated on the east coast of Scotland, between 56° 2′ and 56° 27′ of North Latitude, and between 2° and 2° 56′ of West Longitude from Greenwich. On the south it is bounded by the Frith of Forth, on the east by the German Ocean, and on the north by the Frith of Tay. Its western boundary is irregular, being indented by the county of Kinross, and united by an uneven line with the shires of Perth and Clackmanan. Its greatest breadth, from Elie to Balmerino, is about 19 miles from south to north; and its greatest length, from Fifeness to the extremity of the parish of Saline, is about 48 miles from east to west. It contains about 52.144 square miles, or 263,593 Scottish acres.

Fifeshire.

Climate.

The climate of Fifeshire may be considered as mild and temperate. On the south side of the county, along the shores of the Forth, the air is warm, and friendly to vegetation. On the high grounds which traverse the middle of the county, the soil is damp, and the air cold. The northern parts, which are rather exposed, and destitute of shelter, have a very bleak aspect, and in these the air is sharp and penetrating.

Springs.

There are no remarkable springs in the county. Those which issue from the rocks of the coal-field between the Eden and the Forth, are frequently of the chalybeate kind; and in a few places, as at Kinghorn, of considerable strength. In the middle district of the county, including the valley of the Eden, the springs are frequently saline, and issue either from beds of sandstone or gravel. In the northern portion of the shire, where trap-rocks abound, the springs yield water of the greatest purity. In the Inch Craig of Carnock, adjoining to the dam-dyke, there is a spring of petrolium, producing a liquid resembling ink, which drops almost constantly from the rock.

Lakes.

At a former period, there were numerous marshes and lakes in many parts of Fife, which the hand of industry has changed into fertile fields by means of draining. A few lakes still remain to enliven the scene, and give variety to the prospect. The *Loch of Lindores*, in the parish of Abdie, is surrounded with high uneven ground, and presents a specimen of picturesque scenery seldom equalled. It is about a mile in length, abounds with pike, perch, and eel, and is much frequented by ducks, coots, and other water-fowl. *Kilconquhar Loch* lies on the boundary that divides the parish of Kilconquhar from Elie, is nearly of a circular form, and may be about two miles in circumference. It abounds with pike and excellent eels. In the parish of Auchterderran there are two lakes of considerable size, *Lochgellie* and *Comilla*; the former about three miles, the latter about two miles in circumference; and farther west, in the parish of Beith, we meet with Lochfittie, of an oblong figure, and of equal extent with either of the two last mentioned. To these may be added, *Kinghorn Loch*, in the neighbourhood of the town of Kinghorn, and the small lake at Otterston in the parish of Dalgety.

Rivers.

The rivers of this county (provincially termed *waters* or *burns*) are few in number, and inconsiderable in magnitude, owing to its peninsulated situation. The *Leven* (the only river which Buchanan takes any notice of) issues from the eastern side of the celebrated *Loch Leven* and empties itself into the Frith of Forth at Largo Bay. In its course through Fife, which extends to about twelve miles, it is joined by an inconsiderable stream called the Lothrie, a little below the village of Leslie, and by the united rivulets of the Lochty and the Orr, about half a mile to the westward of Cameron-bridge. This river, the water of which is clear, the supply constant, and the stream weighty, drives the machinery of a great number of mills, which at various periods have been erected on its banks. At its opening into Largo Bay, there is a considerable salmon fishery, and the river also abounds with fine trout, pike, and eels. The eels annually descend from Loch Leven to the sea, in the night-time, during the month of September, and are taken in great quantities by nets placed in the river, which the fishers draw every two hours. The lands of Sthrathendy, before the Reformation, were subject to an annual tax of some thousands of eels to the Abbey of Inchcolm. The river *Eden*, which is formed by the confluence of several small streams, in the parish of Strathmiglo, moves slowly through a level valley, passes the town of Cupar, and unites with the German Ocean a little below the Gair Bridge to the north-east of the city of Saint Andrews. In its course eastwards, which may extend to 20 miles, it is increased by a few tributary streams, and at its confluence with the sea, is joined by the Motray, a rivulet collected among the hills on the left bank of the Tay. At the mouth of the Eden, a few salmon are yearly taken, and it abounds with fine trout, pike, and eels.

Vallies.

Along the south side of the Grampians there is an extensive plain, stretching south-west and north-east, and constituting the great valley of Strathmore; and along the south side of the Ochils, which may be viewed as the outworks of the Grampians, there is a similar valley stretching by Alloa, Kinross, Strathmiglo, Kettle, and Cupar. The eastern portion of this valley, which is situated in Fifeshire, is known by the name of the *How of Fife*. It divides Fife into two natural divisions, a northern and a southern. The bottom of this valley is but little elevated above the level of the sea; so that a canal might very easily be formed which would unite the mouth of the Eden, or the harbour of St Andrews, with Loch Leven, and even with Stirling.

Proposed canal.

Such a canal would be of incalculable advantage to the counties of Clackmannan, Kinross, Perth, and Fife; we may even include Angus, as a lateral branch by Lindores to Newburgh could easily be formed. The conveyance of those indispensible minerals, coal and lime, to districts at present but scantily supplied with either, would be greatly facilitated, as vessels could pass with certainty through this canal in so many hours, which have to wait at present several weeks before they are able to weather the exposed promontory of Fifeness. From the How of Fife, at Collessie, there is a lateral valley which runs into the Tay by Woodmill, Lindores, and Clatchart Craig, and another by Luthrie, Kilmany, and Forgan, terminating in the extensive plain called Tents Moor. These vallies observe the general easterly direction of the ranges of the hills, and contain small eminences of regularly stratified gravel in different parts of their course, as at Collessie, Cupar, and Forgan. We could offer some curious observations concerning the origin of these hills of gravel, were this a proper place to theorise.

Hills.

The hills on the north side of this great longitudinal valley constitute the eastern base of the Ochil hills, with which they agree in direction and constitution. The prevailing rocks are red and white sandstone, amygdaloid, compact felspar, claystone, clinkstone, greenstone, basalt, trap tuff, and wacke. Limestone occurs only at one place on the farm of Parkhill, near Newburgh. These rocks belong to the *old red sandstone formation* of Professer Werner. The more compact rocks of clinkstone, basalt, and felspar, form hills of considerable height, with precipitous acclivities, as Glenduckie hill, Norman's Law, and Lucklaw; while the other rocks of a less durable nature, such as amygdaloid and tuff, form rounded hills, usually covered with soil, as at Balmeadow side, Moonzie, and Forret. The soil of this northern district, chiefly derived from the decay of the trap rocks, is remarkably fertile, and produces grain of the finest quality. Shell marl is here found in some places in great abundance, as at Rossie and Lord's Cairnie. This district affords calcedony, carnelian, and jasper, and considerable quantities of gravel cemented by manganese have likewise been observed.

To the south of the How of Fife, the rocks are of a very different kind, and constitute a part of the great coal field of the river district of the Forth. The most important mineral of this district is *coal*, of which the following subspecies occur: pitch coal, slate coal, and cannel coal. Frequently all these are found in the strata cut through by the same pit; and a mixture of the two former in the same bed is very common. It was in this county where coal was first employed as fuel in Scotland, at least the earliest evidence of its use is said to be a charter of William de Obervill, in which he grants liberty to the Abbot and Convent of Dunfermline to open a coalpit upon his lands of Pityncrieff. This charter is dated the day before the feast of St Ambrose in March 1291. The principal coalworks are situated in the parishes of Dunfermline, Dysart, Wemyss, and Markinch; at the same time it may be mentioned, that beds of coal occur in almost every parish in the district. Glance coal, provincially termed *blind coal*, is likewise a common production, and is used in the drying of malt and other grain, and in the burning of lime. Limestone in this district is very abundant, and in some places is of great purity. It is the compact limestone of mineralogists, and contains numerous petrifactions of shells and corals, and in one or two places the impression of plants. At Lime-kilns on the Forth, the burning of lime is carried on to a greater extent than perhaps in any other county in Scotland. Ironstone is another very common production, and at one time was smelted in a furnace at Balgonie. Sandstone, or *freestone* as it is called, is a rock of frequent occurrence. In many places, it is of a fine grain and durable quality, and is well adapted for architectural purposes. It often contains bituminous wood. The other rocks found in the coalfield are slate clay, bituminous shale, greenstone, basalt, amygdaloid, wacke, and flint. In this district are situated several hills, among which may be mentioned the Binn, the two Lomonds, and Largo Law. In general the ground is moderately level. The soil is very various in quality, owing to the great variety of rocks from which it has originated. In the higher parts, a cold stiff clay prevails, while in the lower grounds the soil is less retentive, and more friendly to vegetation. The precious stone, known by the name of the Elie Ruby, is here found imbedded in a rock of trap-tuff. Lead and copper ores have been observed in different places, and the sulphurated ores of zinc; nay, it appears from the charters of the monastery of Dunfermline, that the hills of Fife formerly yielded *gold*.

Botany.

The native plants of Fife are very numerous. They were, in part, described by the industrious Sibbald, and subsequent botanists have made considerable additions to his list. In the marshes of the county the botanist will find the mare's-tail, *Hippuris vulgaris*; the small water plantain, *Alisma ranunculoides*; the glaucous marsh hitchwort, *Stellaria glauca*; the water fig-wort, *Scrophularia aquatica*; the water hemlock, (provincially known from its deleterious qualities by the name of dcathin,) *Cicuta virosa;* and the basket osier, *Salix Forbyana.* The woods will furnish him with the yellow star of Bethlehem, *Ornithogalum luteum;*[*] the round-leaved winter-green, *Pyrola rotundifolia;* the alternate-leaved golden saxefrage, *Chrysosplenium alternifolium;* and the bird's-nest ophrys, *Epipactis Nidus-avis.* Macduff's cave at Elie will yield him the German Madwort, *Asperugo procumbens;* and the French sorrel of horticulturists. The hills will afford him the alpine bugle, *Ajuga alpina;* the alpine bistort, *Polygonum viviparum;* the common moonwort, *Osmunda Lunaria;* and the rock brakes, *Pteris crispa.* Among the fields of wheat, the smooth rye brome grass, *Bromus secalinus,* appears, a common but unwelcome visitant.

The zoology of Fife is no less interesting than its botany, in consequence of the great extent of sea coast. On the land the zoologist will meet with the rare *Sorex fodiens* in meadow ground, the *Tringa alpina* breeding in the Tents Moor, and the *Sphinx atropos,* a rare visitant of Cupar. The Tay and the Forth will furnish him with the *Pleuronectes Rhombus,* the *Salmo eriox,* and the *Cyclopterus Montagui.* On the shores he may pick up the following shells: *Cæcum* (Dentalium) *imperforatum* and *glabrum,* and *Turbo cingillus,* and if he is in search of the Crustacea and Radiata, the *Pandalus Montagui,* and the *Ophiura aculiata* will reward his exertions.

2. *Civil History.*—The county of Fife at a former period appears to have been of great extent, and to have included the county of Kinross, and part of Clackmannan. The whole district was known by the name of Ross, or the peninsula, and hence Culross signified the lower part of the peninsula, Kinross the head of the peninsula, and Muckross, now Fifeness, the snout of the peninsula. The last division may have obtained its name from the number of wild boars which infested that promontory. At present the county is divided into sixty-one parishes, distributed into four presbyteries, which meet at their respective seats, St Andrews, Cupar, Kirkcaldy, and Dunfermline. These four presbyteries constitute the provincial synod of Fife, which meets at Cupar and Kirkcaldy alternately, and occasionally at St Andrew's and Dunfermline. The county is also divided into four districts for regulating the police, and transacting county business, which are called by the same names, and comprehend the same parishes as the four presbyteries which we have mentioned. The proceedings of these district meetings are reported to the annual general meeting at Cupar, the head burgh of the shire.

The property of the county of Fife is very much divided among the proprietors, and is held by different tenures. Generally the lands hold blench and feu of the crown, sometimes of a subject superior, and in many instances of individual proprietors, these last occupiers being termed feuars. Another class of lands, the property of the royal burghs, is possessed by burgage holding, but which is decreasing very fast, owing to the feus granted by corporations to private individuals. The valued rent of the county is £363,464, 13s. 4d. Scots, proportioned among the different districts in the following manner:

	£.	s.	d. Scots.
Cupar	93,535	13	4
St Andrews	126,013	10	0
Kirkcaldy	87,664	16	8
Dunfermline	56,250	13	4

Freeholders. The number of freeholders at present on the roll amounts to 215. General Wemyss of Wemyss Castle is at present the knight of the shire. In Fife, there are two complete districts of burghs, each of which sends a member to parliament, viz. one comprehending the burghs of Dysart, Kirkcaldy, Kinghorn, and Burntisland; and the other, Pittenweem, Easter and Wester Anstruthers, Crail, and Kilrenny. The burghs of Cupar and St Andrews are united to Perth, Dundee, and Forfar; and Dunfermline and Inverkeithing to Stirling, Queensferry, and Culross. Fife, therefore, has in effect four representatives in parliament, and consequently nearly the eleventh part of the whole representation of Scotland. This, however, is no more than her just share, being nearly in proportion to the valuation and the amount of cess and land tax which are paid.

Population. The population of the county in 1811, amounted to 52,061 males, 55,304 females, making a total number of 107,365 souls. At a former period, the landward districts must have contained a greater number of inhabitants than at present; as in travelling through the county, you frequently meet with rows of ash trees in the midst of cultivated fields, where formerly stood the hamlets of the peasantry. Even in the burghs on the shores of the Forth, ruinous buildings every where present themselves, intimating a former state of prosperity, to which, alas! they are now strangers. The active part of the population of Fife, is engaged either in the pursuits of agriculture, manufactures, or fishing.

Agriculture. Four-fifths of the county are considered arable, and are at present under the management of judicious and active agriculturists. The farm-houses, which formerly were mean in their appearance, and afforded little accommodation to the tenants, are now built of substantial materials, and are both neat and convenient. The size of farms is very various, but on an average may be considered as not exceeding 120 acres. The ordinary duration of a lease is nineteen years. The rents are usually paid in money; and in some cases in the produce of the farm. The enclosures are chiefly formed with stone walls. Thorn hedges, which beautify a country, and yield shelter and warmth to the fields, are disliked by the farmer, on the supposition that they harbour vermin, by which he means small birds. But the same farmer who offers this objection, will not fail to permit forty or fifty pairs of sparrows to hatch their young under his roof in safety in spring, while he will blame the hedges for yielding them shelter in autumn. The distinction between outfield and infield is at present scarcely known in the country; and the high and crooked ridges which formerly prevailed, have been exchanged for a more rational and productive mode of tillage. Summer fallowing and green crops are universally adopted. It would be impossible, without descending to particulars, to mention the rotations of crops which are observed on the various soils which here occur, rotations dictated by experience, sometimes by example, and rarely by theory. The crops commonly cultivated are *oats*, of which there are many varieties; *barley*, and in the colder parts *big*; *wheat* both red and white, spring wheat seldom; *rye* on thin sandy soils; *beans, pease*, and *tares*; *clover* and *rye grass*; *potatoes*, and *turnips* both common and Swedish; *flax* is raised in small quantities, hemp is never at present even attempted. Although there are a great many trees around the mansion-houses of proprietors, there is still much ground in the county fit only for planting, which is at present, comparatively speaking, useless. On many farms, there is not as much wood as would make a gate. Farm-yard dung is the principal manure, and a straw yard is considered as one of the most valuable appendages of farm offices. Lime is universally used, and marl is employed in a few places. Even the refuse of the ironstone mines at Dysart, has been found a profitable manure to the sandy soils of that neighbourhood. It consists of several varieties of bituminous shale and slate clay, and was first applied to this useful purpose by Mr Jameson of Dysart.

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[*] We are happy in having it in our power to enrol this plant as an undoubted native of Scotland. Sir Robert Sibbald mentions it in his list of Scotish plants without adding a habitat, *Prod.* part iv. page 41; and Lightfoot, upon his authority, retains it with suspicion. It was found in Forret Den, near Kilmany, by a very keen and indefatigable botanist, Mr Alexander Chalmers, surgeon, Kirkcaldy.

Live stock.

The Fife breed of black cattle is esteemed profitable for feeding, and for the dairy. They weigh from forty to fifty stones, are usually of a black or brown colour, horns turned up, limbs short, and the body round. The cows give from ten to fourteen Scots pints of milk each day in summer. The breed of horses was formerly very small, and resembled the Highland garrons. But by the introduction of stallions from other parts, the Fife horses are now fit for the saddle and the draught. The native breed of sheep was the common white-faced kind, or mountain sheep, of a small size, with fine wool, which have been banished by the introduction of the black-faced, or Linton breed, with coarse wool, and of a wandering disposition; or by some of the improved cross breeds from England. The swine are principally of the Highland kind, with arched backs, and long bristles. Rabbits are protected in many places, and the annual value of their skins probably exceeds six thousand pounds. The number of pigeons in Fife is very great, the pigeon cotes amounting to nearly three hundred.

Manufactures.

As connected with the agriculture of the county, we may mention that there are four distilleries, three of which prepare whisky for the home market, and the other for the London trade. There are breweries in almost every village, which supply the inhabitants with beer; and strong ale is also compounded by some of the principal brewers. The manufacture of linen, comprehending damasks, diapers, checks, ticks, Osnaburghs, and Silesias, gives employment to a great number of weavers in the different towns and villages. Salt is made in the neighbourhood of the great coal-works on the Forth. The tanning of leather is performed in several places. Soap and candle are manufactured in considerable quantity. Brick and tyle are made at Cupar, Gair Bridge, Kirkcaldy, and Leven. Sulphuric acid is prepared at Burntisland. Ship-building is carried on as a trade at Burntisland, Kirkcaldy, Scotscraig, and Anstruther.

Fisheries.

In consequence of the great extent of sea-coast, we may expect a number of fishing villages, and presume that the county is well supplied with fish. The case is so in reality. A number of fishermen in the towns on the coast, direct their attention to the haddock and cod fishing, and, in their season, catch herring. In the Tay there are extensive salmon fishings, and in the spring, sperlings, *Salmo eperlanus*, are obtained.

Roads.

The county of Fife is intersected by numerous roads, and the materials for keeping them in repair are easily obtained. The more public roads, on which are erected turnpikes, are, with a few exceptions, in excellent condition; but the more private parish roads, in which the proprietors and farmers are materially interested, are in general bad, and in winter nearly impassible. This fault may be fairly charged upon the proprietors, who are too often careless about the management of the road-funds, and entrust the repairs to those interested only about gain, all the while seemingly not averse to the jolting which they often experience. There are few bridges deserving of particular notice. The Gair Bridge over the Eden, consisting of six arches, holds the first rank. It was built in the beginning of the fifteenth century, by Henry Wardlaw, Bishop of St Andrews. On the south coast there are several excellent harbours, of which Burntisland is the safest and most commodious. At a moderate expence a harbour might be constructed at Elie, which, from the depth of water, could be taken at all times of the tide, and would prove a safe retreat to the vessels navigating the Forth. In the Tay there are several ports to which ships resort. The principal of these are Scotscraig, Woodhaven, and Newburgh. The imports are chiefly wood, oak, bark, hides, flax, iron, tar, and groceries. The exports are principally connected with the coasting trade, and consist of coal, lime, grain, and manufactured goods. The ships belonging to the county may be estimated at twenty thousand tons. There are two custom-houses, one at Kirkcaldy, and another at Anstruther. The former has under its management all the ports between Aberdour and Largo, and the latter from Largo to St Andrews. The trade on the Tay is under the inspection of the custom houses of Perth and Dundee.

There is a map of the county, published many years ago by Ainslie, which is now become useless, from the changes which have taken place in the situation of houses and the alteration of the direction of the roads, in consequence of the permanent features of nature, the hills and valleys, springs, and rivulets, not having been attended to. Mr Givan at Cupar is at present executing a new map of Fife, which we expect will be free from those defects, which are but too apparent in a great number of county plans. For further particulars, the reader is referred to Sibbald's *History of Fife and Kinross*, 8vo, Cupar, 1803; and Thomson's *Agriculture of Fife*, 8vo, Edin. 1800.

FIFTEENTH MAJOR, in Music (xv), is an interval, the double of the major eight, or diapason, and thence often called the bisdiapason, the disdiapason, the replicate of the octave, and the quinzieme; its ratio is $\frac{1}{4}$, $= 1224\,\Sigma + 24f + 106m$, and its common log. $=$:8979400.0868.

FIFTEENTH *Minor* (15th), is the octave of the minor eighth, or the doubled minor eighth, as musicians improperly term it, instead of its replicate; and it has the ratio of $\frac{135}{512}$, $= 1177\,\Sigma + 23f + 102m$, and its common log. $=$.4210638,0753.

FIFTEENTH *Stop* on the Organ, is a range of pipes in large organs, which are each tuned a major fifteenth, or double octave above the corresponding pipes in the diapason stops. In accompanying choral parts in churches and concert-rooms, this stop is generally used in conjunction with the open and stop diapasons, the principal and the twelfth stops. (*g*)

FIFTH, in Music, is the numeral designation of an interval, consisting of 5 diatonic degrees, including the lowest and highest of these; but besides the intervals that can properly come under this denomination, a wider range has been improperly taken by various writers, in giving the name of *Fifth*, usually with some prefix, to several different intervals; and mistakes therein can only be avoided by the musical student, by taking the complete view of them, that we have endeavoured to present below, in alphabetical order, (see Vol. II. p. 80.) viz.

Bearing FIFTH, or sometimes *Redundant Fifth*, of Holder is an interval whose ratio is [illegible], =371.947096 Σ + 7 f + 32 m, and its common logarithm = .8170693,1641.

Comma-deficient Major FIFTH (V`), has the ratio $\frac{27}{40}, = \frac{3^3}{2^3.5^3}$ = 347 Σ + 7f + 30m, its log. = .8293037,7283, = .567042 × VIII, = 31.639526 × c; = V—c, = 5—𝒮, 4+t, = VI—II, = 7—3, = T+2t+S, = 2 T+t+L, = 7ƒ+16€+12 Σ; = 2-4ths—3rd; by which last it may be tuned on an organ, &c. This interval has likewise been called the Grave Fifth by Maxwell and Liston, the Less Fifth by Holder, and the Deficient Fifth, by Chambers, Holder, &c.

Comma-deficient Minor FIFTH (5`), has the ratio $\frac{729}{1024} = \frac{3^6}{2^{10}}$, = 300 Σ + 6 f + 26 m, its log. = .852,4275,7167, = .490228 × VIII, = 27.35340 × c; = 5—c, = V—P, = VIII—3 T, = 2 t + 2 S, = 2 T + 2 L, = 2 3rds—2 c, = T + t + S + L, = 2 t + 2 L + 2 c, = 26 c + 14 Σ + 6f, = 6 ƒ + 14 € + 10 Σ; equal also to 4 4ths—2 Vths, by which it may be correctly tuned. This interval has also been called the Ancient Semidiapenta, the Double Trihemitone of some, 23`, 2 (2 S + 𝒮), or 2 (ƒ + S + S); the Deficient Flat Fifth, the False Fifth of Bemetzrieder, the Grave Minor Fifth of Liston, &c.

Comma-redundant Major FIFTH (V′), has the ratio $\frac{160}{243}, = \frac{2^5.5}{3^5}$ = 369 Σ + 7 f + 32 m, its log. = .8185137,0905, = .602881 × VIII, = 33.639526 × c; = V + c, = 5 + P, = 3 T + S, = 2 T + t + S, = T + 2 t + L + 30, = 7 ƒ + 18 € + 14 Σ; = 2 V + 3—2 4ths, whence it may be tuned. It is the acute major fifth of Maxwell and Liston, the greater fifth of Holder, &c.

Comma-redundant Minor FIFTH (5′), has the ratio $\frac{25}{36}, = \frac{5^2}{2^2.3^2}$, = 322 Σ + 6f + 28m, its log. = .8416375,0790, = .526068 × VIII, = 29.35840 × c; = 5 + c, = V—𝒮, = 10th—VI, = 2 T + 2 S, = 6 ƒ + 16 € + 12 Σ; it is the double minor third, or 2 3rds, by which means it may be easily tuned. It is the *tritonus maximum* of Euler, the redundant flat fifth of some writers, the greater diminished fifth of Chladni, the imperfect fifth of Marsh, the acute minor fifth of Maxwell, Liston, &c.

Comma-redundant Sharp (or *superfluous*) FIFTH (✻V′), its ratio is $\frac{256}{405}, = \frac{2^8}{3^4.5}$, = 405 Σ + 8f + 35 m, = .8007849,4909, = .661776 × VIII, = 36.92566 × c; = V + S, = 5 + 2 S, = VI—L, = I + V, = II + IV, IX—5, = XI—7, = XII—8, = 2 III + c, = 3 T + t, = 5 + t + Σ, = 2 T + t + S + S, = 8 ƒ + 19 € + 15 Σ; equal also to 4 V + III—2 VIII, = 2 V + III—2 4ths, by either of which last it may be tuned. This interval is the minor comma defective major sixth, or VI—€.

Deficient FIFTH of Chambers, Holder, &c.; its ratio is $\frac{27}{40}$, = 347 Σ + 7 f + 30. See *Comma-deficient Major* FIFTH.

Deficient FIFTH of other writers, has the ratio $\frac{729}{1024}$, = 300 Σ + 6f + 26 m. See *Comma deficient Minor* FIFTH.

Fifth.

Diaschisma-defective Major FIFTH (V✻`); its ratio is $\frac{177,447}{262,144}, = \frac{3^{11}}{2^{18}}$, = 346 Σ + 7 f + 30 m, its common log. is .8297988,7996, = .565417 × VIII, = 31.548683 × c; = V—∂, = 5 + Σ—𝒮, = 5—ƒ—€, 5 + 2c—S, = 4 + 2L, = 5 L + 2 P, = 4 t—∂, = T + 2 t + 3 S, = 5 T + ƒ + r, = 7 ƒ + 16 € + 11 Σ, = 30 c + 17 Σ + 7 f. This interval is the resulting, bearing, or wolf fifth, when 11 perfect fifths are tuned in succession, in 7 octaves, or = 7 VIII —11 V; and 7 4ths—4 V: by either of which it may be tuned.

Diminished FIFTH, the greater of Chladni. Its ratio is $\frac{25}{36}$, = 322 Σ + 6 f + 28. See *Comma-redundant Minor* FIFTH.

Diminished FIFTH, the least. Its ratio is $\frac{375}{512}$, = 275 Σ, + 5 f + 24 m. See *Extreme Flat Minor* FIFTH.

Diminished FIFTH, the lesser of Chladni. Its ratio is $\frac{45}{64}$, = 311 Σ + 6 f + 27 m. See *Minor* FIFTH.

Double Comma-deficient Major FIFTH (V``), has the ratio $\frac{2187}{3200}, = \frac{37}{2^7.5^2}$, = 336 Σ + 7f + 29m, its log. = .8346988,0472, = .549121 × VIII, = 30.63952 × c; = V—2 c, = 5 + ƒ, = 3t + S, = T + 2 t + L, = 29 c + 17 Σ + 7 f, = 7 ƒ + 15 € + 11 Σ; also equal to 4 4ths—V—2 3rds: By which means this interval may be tuned.

Double-Comma redundant Sharp FIFTH, (✻V″); its ratio is $\frac{4096}{6561}, = \frac{2^{12}}{3^8}$, = 416 Σ + 8 f + 36 m; its log. is .7953899,1021, = .679696 × VIII, = 37.92564 × c; = V + P, = 5 + S + P, = 5 + T + Σ, = 4 T, = 2 III + 2 c, = 4 P + 4 L, 36 c + 20 Σ + 8f, = 8 ƒ + 20 € + 16 Σ; also equal to 8 V—4 VIII, = 4 V—4 4ths, by either of which it may be tuned. This interval is also called the Double Ditone, the Quadruple Major Tone, and the Superfluous Fifth of Bemetzrieder; it is also the Schisma-excessive Minor Sixth, or 6 + Σ, (6✻).

Double Superfluous Minor FIFTH, has a ratio of $\frac{81}{125}, = \frac{3^4}{5^3}$, = 383 Σ + 8 f + 33m; its log. is .8115750,0587, = .625935 × VII, = 34.92566 × c; = 5 + 2𝒮, = V + ƒ, = V + 𝒮—c, = T + 3 t, = 33 c + 18 Σ + 8 f, = 8 ƒ + 17 € + 13 Σ; equal also to III + 2 4th — 2 3rds, by which it may be tuned.

Equal-beating FIFTHS, are such as, when tuned in succession, *beat* equally quick; of which there are a considerable number and variety. See the article EQUAL BEATING, where the values of several of them are given, and a general theorem, by which such fifths may be calculated in any given case.

Extreme Diminished FIFTH has the ratio [illegible], = 275 Σ + 5 f + 24 m. See *Extreme Flat* (minor) FIFTH.

Extreme Flat (major) FIFTH of Liston, (♭V), has the ratio $\frac{45}{64}$ = 311 Σ + 6f + 27m. See *Minor* FIFTH.

Extreme Flat (minor) FIFTH of Liston, (♭5); has the ratio $\frac{375}{512}, = \frac{3.5^3}{2^9}$, = 275 Σ + 5f + 24 m; its log. is = .8647681,0675, = .4492528 × VIII, = 25.06728 × c; = 5—𝒮, = V—S—𝒮, = V—2 𝒮—c, = T + 3 S, = 4th + ε, = 24 c + 11 Σ + 5 f, = 5 ƒ + 14 € + 10 Σ; it is also equal to 6+4—2III, or 11—3III, by either of which it may be tuned. This interval has also been called by some the Diminished, and the Extreme Diminished Fifth, and it is the Minimum Fifth of Henfling.

Extreme sharp (major) FIFTH of Liston (✻V): the ratio is $\frac{16}{25}$, $=\frac{2^4}{5^2}$, =394Σ+8f+34m; its log. is .8061799,7398, =.6438566×VIII, =35.92564×c; =V+𝒮, =6+𝔖+𝒮, =5+2𝒮+c, =6—ε, =VI—2, =VII—3, =X—6, =VIII—♭4th, =2T+2t, =2T+t+S+𝒮, =4S+2𝔖+2𝒮, =34c+20Σ+8f, =8𝒻+18€+14Σ; it is also equal 2VIII—2 6th, =2VI—2 4th, =2V—2 3rds, and =2III, from any of which, but the last in particular, it may be readily tuned. This interval has also been called, the Tretratonon by Dr Callcot, the Superfluous (major) Fifth, by Tartini, Marsh, Chladni, &c. the Sharp Fifth, the Redundant (major) Fifth of Liston; also, the Double major Third, the least Sixth of Holder, the Diesis Defective minor Sixth of Euler, and of the Trumpet scale ($\frac{1}{25}$). Mr F. Webb has lately said, that the ratio of this interval, nearly corresponds with that of the diameter of a semicircle to its arc, taken as $\frac{14}{22}$, =399348463Σ+8f+34m: whereas the true diesis and arc, give 389.55534Σ+8f+34m.

False FIFTH of Chambers and Bemetzrieder; its ratio is $\frac{45}{64}$, =311Σ+6f+27m. See the *Minor* FIFTH.

False Minor FIFTH, of the common trumpet scale ($\frac{1}{23}$); its ratio is $\frac{16}{23}$, =320.460258Σ+6f+28m, =5th+9.0460258Σ+m: and its com. log. =.8423921,4664.

Flat FIFTH, of Overend, &c. (♭V), has a ratio $\frac{45}{64}$, =311Σ+6f+27m. See *Minor* FIFTH.

Flat FIFTH of Hussey and Webb, has the ratio $\frac{7}{10}$, =314.947096Σ+6f+27m, and its common log. is .84509080,4001: it is also their lesser fifth, and the sharp fourth of Holder.

Greater FIFTH of Holder, has the ratio $\frac{160}{243}$, =369Σ+7f+32m. See *Comma-redundant Major* FIFTH.

Imperfect FIFTH of Marsh, has the ratio $\frac{25}{36}$, =322Σ+6f+28m. See *Comma-redundant Minor* FIFTH.

Isotonic FIFTH, or *Equal-Temperament Fifth*, has the ratio 1+²√2, =357.0072072Σ+7f+30m, =357Σ+7f+30$\frac{11}{12}$m, its log. is .8243991,6920, =$\frac{7}{12}$VIII, =V—Σ—$\frac{1}{12}$m, =5+L—$\frac{1}{12}$m; and the length of string answering thereto, is .6674199. See ISOTONIC, and FAREY'S EQUAL TEMPERAMENT.

Less, or Lesser FIFTH of Holder; its ratio is $\frac{27}{40}$, =347Σ+7f+30m. See *Comma-deficient Major* FIFTH.

Lesser FIFTH of Hussey and Webb. See their *Flat* FIFTH.

Major FIFTH, (V) is a concord, that is very commonly denominated the Perfect Fifth, or simply the *Fifth*; it has the ratio of $\frac{2}{3}$, =358Σ+7f+31m; its common log. is .8239087,4094, =.5849626×VIII, =32.639526×c, 359.2913613×Σ; =5+𝔖, =I+5, =2+IV, =II+4; =6—2, =VII—III, =9—5, =IX—V =11—7, =XI—VII, =12—8: =4+T, =4L+8P, =3T+L, =2T+t+S, =4S+2𝔖+S, =4𝔖+2S+𝒮+2€, =T+2t+L+2c, =31c+17Σ+7f, =7𝒻+17€+13Σ: it is also =3+III, =VIII—4, =10—6=X—VI, by which its tune may be checked, and adjusted to the greatest nicety.

This interval was anciently called the Pentachord; the Diapente of Holder, &c.; the Hypate prima of Henfling; the quint of Earl Stanhope; and on account of its great importance in the scale, the upper of its notes, above the key-note, is very commonly called the Dominant. This interval is heard in a very marked manner on the trumpet, or a freely sounding string, owing to its numerous replicates, $\frac{1}{3}$, $\frac{1}{6}$, $\frac{1}{12}$, $\frac{1}{24}$, &c, that are usually heard in the higher octaves: it can be tuned, by the judgment of the ear, with equal readiness, and with more accuracy than the octave or unison, and being, (except its compliment the minor fourth,) the only concordant or tunable interval, that being 12 times repeated, (and returning by octaves as often as is necessary,) produces as many different notes, that are not greatly different nor equi-distant from each other, and the last of such notes nearly coinciding with the octave of the first; on which account, it is the interval almost exclusively used in the tuning of instruments. See *Succession of* FIFTHS, and TEMPERAMENT.

Major FIFTH of Hussey, has the ratio $\frac{7}{11}$=399.348463Σ+8f+34m, and its common log. =.8037053,5486.

Mean-tone FIFTH, has the ratio 1 ÷ ⁴√5, =355.2558968Σ+7f+30m, =355$\frac{1}{4}$Σ+7f+30$\frac{3}{4}$f; its log. is =.8252574,9892, =V—$\frac{1}{4}$c, =$\frac{1}{4}$XVII; this tempered fifth, four times repeated, has the peculiar property of producing an exact replicate of the Major Third, and gives the only system that seems adapted to the tuning of the common organ; M. Loeschman likewise uses it, with excellent effect, in tuning his patent enharmonic piano-fortes and organs, with 24 sounds in each octave.

Minimum FIFTH of Henfling; its ratio is $\frac{175}{128}$, =275Σ+5f+24m. See *Extreme Flat* (minor) FIFTH.

Minor FIFTH (5) has the ratio $\frac{45}{64}$, $=\frac{3^2.5}{2^6}$ =311+6f+27m; its log is .8470325,8979, =.5081467×VIII, =28.35340×c; =V—𝔖, =4th+S, =2 3—c, =2+4, =V—I, =6—II, =7—III, =8—4, =VIII—IV, =9—V, =11—VII, =III+2S, =T+t+2S, =4S+𝔖+𝒮, =2S+3𝔖+𝒮+2€, =27c+14Σ+6f, =6𝒻+15€+11Σ; it is also =2 4th—III, by which it may be tuned. This interval was anciently called the Hemidiapente, or Semidiapente; it is the Tritonius of Euler, the False Fifth of Chambers and Bemetzrieder, the Lesser Diminished Fifth of Chladni, the Flat (major) Fifth, and the Extreme Flat (major) Fifth of Liston, (♭V).

Minor-Comma excessive Major FIFTH (V✻′); its ratio is $\frac{675}{1024}$, $=\frac{3^3.5^2}{2^{10}}$, =368Σ+7f+32m, its log. is .8190038,1619, =.6012559×VIII, =33.54859×c, =V+€, =5+S, =2+5, =6—I, =8—III, =9—IV, =12—VII, =T+t+3S, =32c+6Σ+7f, =7𝒻+18€+13Σ; it is also =3 4th—2 III, by which it may be tuned. It is the diminished (minor) sixth of Liston.

Redundant flat FIFTH (♭V′) of some writers, has the ratio $\frac{25}{36}$, =322Σ6f+28m. See *Comma-redundant Minor* FIFTH.

Redundant (*Major*) FIFTH of Liston (✻V); its ratio is $\frac{16}{25}$, =394Σ+8f+34m. See *Extreme sharp* (*Major*) FIFTH.

Redundant FIFTH of Holder, has the ratio $\frac{21}{32}$, =371.947096Σ+7f+32m. See *Bearing* FIFTH.

Schisma defective Major FIFTH (V✻), has the ratio $\frac{10935}{16384}$, $=\frac{3^7.5}{2^{14}}$, =357Σ+7f+31m; its log. is .8243988,4807, =.583334×VIII, =32.54869×c; =V—Σ, =5+L, =VI—2𝔖, =III+3—Σ, =2t+3S, =31c+16Σ+7f, =7𝒻+17€+12Σ, =5 4ths—2V—III, by which means this equal-temperament Fifth of Farey's system may be tuned. Its length of string is .6674194, and above the tenor cliff c of 240 vibrations, it will beat flat .81202 per second.

Sharp (*Major*) FIFTH (✻V), has the ratio $\frac{16}{25}$, = 394Σ+8f+34m. See *Extreme sharp* (*Major*) FIFTH.

Sharp FIFTH of Holder, has the ratio $\frac{9}{14}$, =390.52904Σ +8f+34m, and its log. =.8081144,7376. The respectable author above named, has not only been betrayed into the admission of this unmusical ratio, but to the naming it also his Deficient less sixth, and his Redundant great third, in different parts of his Essay.

Successive FIFTHS, or the succession of fifths, implies the order in which they arise, in modulation; these, beginning towards the lowest arc, according to Mr Liston, B♭♭, F♭, C♭, G♭, D♭, A♭; E♭, B♭, F, C, G, D, A, E, B, F✻, C✻, G✻; D✻, A✻, E✻, B✻, F✻✻, C✻✻; who, at page 24 of his *Essay on Perfect Intonation*, remarks, that the six first and six last of the above, (leaving a chromatic douzeave scale in the middle), are denominated *extreme flat* or *extreme sharp* notes; and so also are any other double flat or double sharp notes called, that may be produced by further extending this series either way. If the fifths, in the above series, are *perfect*, they answer to the TRIPLE *progression* of the ancients. See that article.

Superfluous (major) FIFTH of Tartini, Chladni, Marsh, &c. has the ratio $\frac{16}{25} = 394\,\Sigma + 8\,f + 34\,m$. See *Extreme sharp*, (major) FIFTH (✻V.)

Superfluous FIFTH of Bemetzrieder; its ratio is $\frac{4096}{6561}$, $= 416\,\Sigma + 8\,f + 36\,m$; see *Double-comma redundant sharp* FIFTH.

Temperaments of the FIFTHS: in *regular tempered douzeaves*, eleven of the major fifths are each tempered by one-fourth of the temp. of the IIIrd —2.7519656Σ; and the resulting, or wolf fifth, is tempered by 18.2637592 Σ — eleven-fourths of the temp. of the IIIrd; and, at the same time, eleven of its fifths are each tempered by 3.6692875 Σ — one-third of the temp. of the VIth; and the resulting, or wolf fifth, is tempered by eleven-thirds of the temp. of the VIth — 28.3542997 Σ; and further, whatever be the temperament of each, of eleven of the fifths, the other, or wolf-fifth, will be 12,0078624 Σ — these eleven temperaments of the Vths. See Mr Farey's musical theorems and corollaries, in the *Phil. Mag.* vol. xxxvi. p. 39, and 374.

Triequal FIFTHS, or quints, of Earl Stanhope; there are three successive tempered fifths, that are either equal in magnitude, or that beat equally quick. See EQUAL BEATING, and TRIEQUAL QUINT. (*ε*)

FIGS. See CAPRIFICATION.

FIGUERAS, is a town of Spain, in the province of Catalonia, situated in a rich and cultivated plain of great extent It has a parish church and two convents, one of Cordeliers, and another of Capuchins, an hospital, and a small garrison. The houses are not well built, but the streets are wide, and there is a square with piazzas round it. There are two tolerable inns in the town. A citadel was built on a little eminence near Figueras, in the reign of Ferdinand VI. at a great expence. It is called the castle of St Ferdinand, and is extremely magnificent, being reckoned one of the finest fortifications in Europe. The walls, which are very thick, are of free stone; the moats are deep and wide, and the approaches are mined. The ramparts, magazine, stables, cellars, caverns, and hospital, are defended by a casement. It has the form of an irregular pentagon, like the flaps of pointed pockets, and it stands nearly in the middle of a great plain, which it can defend on every side, serving as an entrenched camp for about 17,000 men. This place was, however, taken by the French in 1796; and in the council room of the fortress are still to be seen spots of ink, occasioned by the rage of an officer who threw his pen against the wall when he heard of the event. The walls have been whitened, but the ink is still visible. The plain on which Figueras is situated, is covered with fruit, wheat, rice, vegetables, flax and hemp. Population 4000. See Laborde's *View of Spain*. (*j*)

FIGURE OF THE EARTH. See ASTRONOMY.

FILE, a well-known steel instrument, having teeth on the surface for cutting metal, ivory, wood, &c.

When the teeth of these instruments are formed by a flat sharp-edged chissel, extending across the surface, they are properly called *files*; but when the tooth is formed by a sharp-pointed tool, in the form of a triangular pyramid, they are termed *rasps*. The former are used for all the metals harder than lead or tin; and the latter for the softer metals, ivory, bone, horn, and wood.

Different kinds of files.

Files are divided into two varieties, from the form of their teeth. When the teeth are a series of sharp edges, raised by the flat chissel, appearing like parallel furrows, either at right angles to the length of the file, or in an oblique direction, the files are termed *single cut*. But when these teeth are crossed by a second series of similar teeth, they are said to be *double cut*. The first are fitted for brass and copper, and are found to answer better when the teeth run in an oblique direction. The latter are suited for the harder metals, such as cast and wrought iron and steel. Each tooth presents a sharp angle to the substance, which penetrate the substance, while the single cut file would slip over the surface of these metals. The double cut file is less fit for filing brass and copper, since the teeth would be very liable to be clogged with the filings.

Files are called by different names, according to their various degrees of fineness. Those of extreme roughness are called *rough*; the next to this is the *bastard cut*; the third is the *second cut*; the fourth the *smooth*; and the finest of all the *dead smooth*. The very heavy square files used for heavy smith-work, are sometimes a little coarser than the *rough*; they are distinguished by the name of *rubbers*.

Different shapes of files.

Files are also distinguished for their shape, as *flat*, *half-round*, *three-square*, *four-square*, and *round*. The first are sometimes of uniform breadth and thickness throughout, and sometimes tapering. The cross section is a parallelogram. The *half-round* is generally tapering, one side being flat, and the other rounded; the cross section is a segment of a circle, varying a little for different purposes, but seldom equal to a semicircle. The *three-square* generally consists of three equal sides, mostly tapering; those which are not tapering are used for sharpening the teeth of saws. The *four-square* has four equal sides, the section being a square. These files are generally thickest in the middle, as is the case with the smith's rubber. In the round file, the section is a circle, and the file generally conical.

On the steel used for files.

The heavy and coarser kind of files are made from the inferior marks of blistered steel. That made from the Russian iron, known by the name of *old sable*, and also called from its mark CCND, is an excellent steel for files. Some of the Swedish irons would doubtless make the best file steel; but their high price would be objectionable for heavy articles.

The steel intended for files is more highly converted than for other purposes, to give the files proper hardness. It should, however, be recollected, that if the hardness is not accompanied with a certain degree of tenacity, the teeth of the file break, and do but little service.

Small files are mostly made of cast steel, which would be the best for all others, if it were not for its higher price. It is much harder than the blistered steel, and from having been in the fluid state, is entirely free from those seams and loose parts so common to blistered steel, which is not sounder than as it came from the iron forge before conversion.

The smith's rubbers are generally forged in the common smith's forge, from the converted bars, which are, for convenience, made square in the iron before they come into this country. The files of lesser size are made from bars or rods, drawn down from the blistered bars and the cast ingots, and known by the name of tilted steel.

The file maker's forge consists of large bellows, with coak as fuel. The anvil block, particularly at Sheffield, is one large stone of millstone girt. This anvil is of considerable size, set into and wedged fast in the stone. The anvil has a projection at one end, with a hole to contain a sharp-edged tool for cutting the files from the rods. It also contains a deep groove for containing dies or bosses for giving particular forms to the files.

The flat and square files are formed entirely by the hammer. One man holds the hot bar, and strikes with a small hammer. Another stands before the anvil with a two-handed hammer. The latter is generally very heavy, with a broad face for the large files. They both strike with such truth as to make the surface smooth and flat, without what is called hand-hammering. This arises from their great experience in the same kind of work. The expedition arising from the same cause is not less remarkable.

The half-round files are made in a boss fastened into the groove above-mentioned. The steel being drawn out, is laid upon the rounded recess, and hammered till it fills the die.

The three-sided files are formed similarly in a boss, the recess of which consists of two sides, with the angle downwards. The steel is first drawn out square, and then placed in the boss with an angle downwards, so that the hammer forms one side, and the boss two. The round files are formed by a swage similar to those used by common smiths, but a little conical.

The whole of the working part of the file is formed and finished with the hammer before it is cut off from the rod. The finished part is then held in tongs, and heated a second time to form the tang of the file.

The very square shoulder formed by the tang of a file, does not seem easy to form by the hammer. This is effected by first placing the file upon a sharp-edged tool, standing with its edge upwards in the anvil; a notch is now made on each side where the tang commences. It is then brought to the front edge of the anvil, and, by an acquired dexterity, the tang is drawn out without touching the shoulder with the hammer.

Process of annealing.

In order to prepare the files for cutting, they require to have the surface perfectly metallic, smooth, and as even as possible. The state, however, in which the files leave the hammer, is too hard for the dressing and cutting. The first thing to be done, therefore, after forging, is to soften the files by a process called *annealing*. This was formerly, and by many is still, performed by surrounding a close mass of the files with coals, keeping up the fire till the whole mass become red hot, and allowing them to cool gradually. In this process the files become softened, but the surface becomes so oxidated, that a stratum of considerable thickness peels off. This scale, however, is very hard, and is removed but with difficulty. This last is not the greatest evil attending this process; the surface of the steel lying immediately under the oxide, must have partly lost its property of steel. Indeed it is now known, that, by a similar process, steel, and even cast iron, can be converted into pure iron. It will be obvious, that, by the oxidation which takes place, the part which has to form the teeth of the file will be much impaired by the abstraction of its carbon. Hence it will forcibly strike any one, that steel, particularly in this instance, should be annealed in close vessels, to exclude the oxygen. This has been accomplished to a partial extent by some manufacturers, but still requires more minute attention. The annealing should be performed in troughs of fire-stone or fire-brick, similar to the cavities in which steel is converted, having the flame of a furnace playing on every side, and over the top. The trough should be filled with alternate strata of the files to be annealed, and coal-ashes, or the dust of the coaks, formed in the forge-hearth. The upper stratum of files should be covered with a thick stratum of the dust, and lastly with a mixture of clay and sand. The heat should be kept up no longer than till the mass will become red hot, quite through. The whole must now be suffered to cool. When the files are withdrawn, instead of being scaled as in the old method, they will exhibit a metallic surface, and the substance will be much softer than by the common annealing.

It should be here observed, that the mass to be heated should not be more than one foot in thickness, as it would be so long in heating and cooling, that the metal would put on the crystalline form, under which it is too brittle to form a cutting edge.

We have before observed, that the steel requires high conversion for files. This will evidently become unnecessary with this mode of annealing. The surface of the files, which is the principal part, will become converted in an extra degree, by using more carbon in the annealing, and thus make steel, of common conversion, sufficiently hard for files.

Preparati of the su face for th teeth or stripping

The next process is the preparation of the surface for the teeth of the files. This, when it is done by means of filing, as practised in Lancashire, is called *stripping*. At Sheffield, the surface of the file has no other preparation for cutting than by grinding. This is done by machinery, and at a trifling expence.

The great expedition with which the grinding of files is performed, and the little attention paid by the workman, who is totally unacquainted with every other department, cannot insure that evenness of surface which is of so much importance in the working of a file, and which is more successfully performed by stripping.

The grinding-stone would require constant examination to keep it sufficiently true for grinding an even surface, except some additional machinery could be employed for that purpose. This will doubtless be some time or other accomplished.

In the present state of the file manufacture, the larger files must be prepared on the present plan, and must imperfect for want of the surface being even. is not the case before the file is cut, it will, on be found to touch the surface to be filed only in points, instead of the whole of the teeth touch- once. It is in this particular that the Lancashire ave so much surpassed those made at Sheffield irmingham. The first are prepared solely by ing; and, in consequence, their trade is confined small cast-steel files, for which they easily get a double that of similar Sheffield files. When the facturers of the latter are told that it is in this ular that they are defective, it seems wonderful ey do not either adopt some process analogous pping, or contrive some machinery to grind them exactly.

e stones used at present for grinding files, are of gritstone, and of considerable size, for the large from four to five feet in diameter. They wear down to about 30 inches, and then sell them to rk-grinders. The grinder sits so as to lean over one, which turns directly from him, and presses e file with both hands. The files are now trans- d to the cutter. The expedition and exactness which the teeth of files are cut, is not surpassed ay mechanical art, depending like it solely upon n dexterity.

e file-cutter requires an anvil of a size greater or proportioned to the size of his files, with a face en and flat as possible. The hammers are from to five or six pounds. His chissels are a little der than the file, sharpened to an angle of about egrees. The length is sufficient to be held fast be- n the finger and thumb, and of strength sufficient o bend with the strokes of the hammer, the mag- de of which may be best conceived by the depth he impression. The anvil is placed in the face of ong wooden post, to which a wooden seat is at- ed a small distance below the level of the anvil's . The file is first laid on the bare anvil, one end jecting over the front, and the other over the back e of the same. A leather strap now goes over h end of the file, and passes down on each side the k to the workman's feet, which, being put into the p on each side, like a stirrup, holds the file firmly n the anvil while it is cut. While the point of the is cutting, the strap passes over one part of the file y, while the point rests upon the anvil, and the g upon a prop on the other side of the strap. When side of the file is single cut, a fine file is run slight- over the teeth, to take away the roughness, when y are to be double cut, and another set of teeth are t, crossing the former nearly at right angles. The is now finished on one side, and it is evident that cut side cannot be laid upon the bare anvil to cut other. A flat piece of an alloy of lead and tin is terposed between the toothed surface and the anvil, hile the other side is cut, which completely preserves e side already cut. Similar pieces of lead and tin th angular and rounded grooves, are used for cutting ree-square and half-round files.

Rasps are cut precisely in the same way, using a tri- gular punch instead of a flat chissel. The great art cutting a rasp is to place every new tooth opposite a vacancy as much as possible.

Although smooth files have many more teeth, they not proportionate in labour; since more strokes can made in the same time, as they are of less magni- de. In cutting a flat side, about ½ inch broad, of the bastard cut fineness, a quick workman will make about 300 strokes, and as many teeth in one minute.

The smaller files are generally cut by women and children, who very soon acquire great dexterity.

The file-cutter, whatever may be the degree of fineness of the file, depends much more upon his feeling than his eyes. Indeed, their eyes are frequently directed to other objects while the chissel and the hammer are going at the full rate.

When one tooth is formed, the edge of the chissel and the surface of the file being both very smooth, the former is pushed up against the back of the first tooth, which can be much better felt than seen. By this succession of stroke and motion of the chissel, to feel the last tooth, the work is performed, although the eye is at a considerable distance from the work.

Process of hardening the files.

When the files are cut, the next process is to harden them. This is effected by heating them to redness, and quenching them in cold water. Some previous steps are taken to prevent the action of the oxygen of the atmosphere upon the file when red hot, and a peculiar manner of immersing the file in the water, which we shall more particularly dwell upon.

The preparing process has been improved within these ten years, so far as regards economy. The files were, before that time, first smeared with the residuum of ale barrels, commonly called *ale grounds*, and then covered over with common salt in powder, which was retained merely by the adhesive nature of the *ale grounds*. They were now dried before the fire. The files were now taken once or twice and heated in a smith's fire, made of small coaks, frequently moving the file backward and forward, in order to heat it uniformly red hot. At this period the file gives off a white vapour from the surface, which is the salt in the act of subliming. The surface appears at the same time covered with the salt in a liquid state, which, like a varnish, preserves the surface from the oxygen of the atmosphere, during the time it is red hot. The file is now held in a perpendicular position, and the immersion in the water commences at the point, slowly depressing it up to the tang, which should not be hardened. All files are dipped in a perpendicular direction. Those, however, which have a round side and a flat one, are moved also in a horizontal direction, with the round side foremost. Without this precaution, files of this shape would warp towards the round side. This arises from the flat side having been more hammered than the round side, which is formed by the concave die, and does not acquire the same density which the hammer gives.

It is common after hardening to temper most cutting instruments. Files, however, are never tempered at all by the maker. Nor are any but *rough* and the *bastard-cut* files tempered by those who use them. If these were not in some cases tempered, the points of the teeth would break, and the file would do but little service.

When files are hardened, they are brushed with water and coak-dust. The surface becomes of a whitish-grey colour, as perfectly free from oxidation as before it was heated.

In applying the salt, as above directed, a very great proportion of it is rubbed off into the fire and is lost. The consumption of salt used in this manufacture at Sheffield alone, amounted to about £1000 annually. The economy with which it is now used, has reduced this quantity to less than £300. This saving is effected by mixing *ale grounds* and the salt together, the

Process of hardening the files.

salt being in such proportion as just to be taken up by the aqueous part of the *grounds*, which should not exceed 3lb. of salt to 1 gallon of *ale grounds*. The files require only to be smeared thinly with the mixture, which, when dry, adheres firmly to the surface, till the salt fuses. The manner of heating files for hardening has been also improved. Instead of putting the files singly into a coak fire, a fire-place or oven is formed, into which the blast enters. Two iron bearers are placed on the upper part of the cavity to support a number of files at once; these are heating gradually while the workman continues to select the hottest, and in a hotter part of the fire gives them the full degree of heat required for dipping them into the water.

Some manufacturers pretend to possess secrets for hardening, by introducing different substances into water, such as sulphuric and muriatic acid. The quantities, however, are so small, that if those bodies could be shown to possess any such qualities, the effect must be trifling.

The only means which can be employed to increase the hardness of files, is by more highly carbonating the surface of the file. This may be effected in a very simple manner. No more is necessary for this purpose than to introduce some animal carbon in fine powder into the hardening composition above mentioned. This carbon may best be obtained from the refuse leather of shoemakers and curriers. They should be introduced into a vessel of cast or wrought iron, leaving only one small opening for the escape of vapour. The vessel being surrounded by a fire capable of heating the vessel red hot, the heat must be kept up till no more vapour escapes; the hole must then be closed, and the whole suffered to cool. The contents of the vessel will be found to be a hard shining coal, which, being reduced to powder, will be fit to mix with the composition. As a proof of the efficacy of this substance in giving greater hardness to the files, if a file be made of iron, and cut in the usual way, by covering it with a mixture of the salt, ale grounds, and powdered carbon, heating it red hot, and quenching it in cold water, the surface will become perfectly hard, and files may be made in this way, which, at the same time that they will bend into different forms, are hard enough to file wood, stone, and even metals.

Some have attempted to facilitate the manufacture of files, by cutting the teeth by a machine. Mr Nicholson the journalist, took out a patent for this purpose. The most certain proof, however, that the saving is not very great, is that, to the best of our knowledge, there is not any such machine in use. A great difficulty would arise from the great variety of files, in point of shape and size, which would require the magnitude of the stroke to be so constantly varied, that it would either require a great number of machines, or require them to be too complicated. But the great objection is said to be in the imperfection of the tooth raised by the machine. (c. s.)

FILICES, OR FERNS.

One of the great natural series of plants included with the *Musci*, *Hepaticæ*, *Lichenes*, *Confervæ*, &c. in the CRYPTOGAMIA of Linnæus, and ACOTYLEDONES of Jussieu. The writers on these plants have differed widely in their opinions as to the etymology of the word *filices*. Ainsworth derives *filix*, the name used by Pliny, from *filum quasi filatim incisæ*; but Ainsworth was no naturalist: even the roots of these plants have no more resemblance to *filum*, "a thread," than those of other plants. It seems far more probable that the latter name is derived απο των φυλλων (*foliis*); the leaves or fronds of the European ferns being alone visible, as the stems and roots are either hid under ground, or decayed leaves, mosses, &c.

I. *On the Germination of the Seeds, and Physical Economy of Ferns.*

In describing the peculiarities in the structure of the embryo and manner of germinating of the seeds of these plants, it is necessary, for the sake of perspicuity, to present a general comparative view of the analogous parts of the embryo in dicotyledonous plants. For, as to the supposed monocotyledones, it will scarcely be credited, that in them naturalists have not hitherto determined with precision, to which part of the embryo the term *cotyledon* ought with propriety to be applied. In fact, there is every reason to conclude, that no organ whatever, strictly analogous with the true cotyledon, exists in the seeds of the hitherto supposed monocotyledonous series; although all of them are, independent of this, sufficiently distinguished by the peculiarities of their respective organization. It is therefore in the seed-lobes of the well known dicotyledones, that we find the true types of the real cotyledons; and, by comparing these with the organs of the embryo in other germinating seeds, and especially observing the purposes to which they are destined in the economy of this interesting process, that we are enabled to determine, with accuracy, their true nature. It was with this view that the experiments of Lindsay, who, it will be recollected, first called the attention of naturalists to the germination of ferns,* were lately repeated by the author of the present observations.

Gærtner, to whom the greatest obligation is due in many respects, has denied the existence of cotyledons in these plants, asserting that the testa of the seed is in them, as well as in those of *Musci* and *Fuci*, totally occupied with *vitellus*, an organ to which he has ascribed a distinct character. Lindsay has described this part as appearing of an irregular form; which is indeed sufficiently expressed in his Figures (8. 9. 10. 11. Pl. II.) *ut supra*. But, after repeated observations on the germinating seeds of various genera, this supposed irregularity has never once occurred to us; indeed, anomalies of this kind, so far as we know, never do occur in the figure of the embryo, in the same natural series; in which, with certain shades of difference, the characteristic structure of the kindred tribes invariably exists. Without, however, impeaching the accuracy of Lindsay, may not the evident incongruity of his figures with each other be explained, by supposing the engravings to have been executed during his absence in the West Indies, from which the original drawings, now in the possession of Dr Wright of Edinburgh, were sent?

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* *Transactions of the Linnæan Society*, vol. ii.

Erhart, whose observations were made on two species of *Aspidium* and one *Athyrium* only, coincides with Lindsay in representing but one lobe in the embryo.[*] But the figure of the embryo, as observed by Sprengel, is described with much more accuracy han by either of these writers, although he had an opportunity of seeing only a single species, the *Athyrium Filix fœmina*, in a state of spontaneous germination.[†] Having, however, had the good fortune to observe, from its commencement, the germinating process, in several species belonging to genera so clearly distinct, that they must be considered as belonging to different tribes, namely, the *Polypodiaceæ*, *Aspleniaceæ*, and *Pterideæ*; and having traced the embryo from becoming visible as a dark green point, to its gradual expansion and final evolution as a perfect plant, we have succeeded so far in determining with precision the figure and manner of growth of their various organs, which are here delineated by the accurate pencil of Mr Syme, during what may be termed the *first and second periods* of the existence of this singular race.

First Period.

Fig. 1. Represents the seed-lobes somewhat magnified, soon after becoming visible to the naked eye.

Fig. 2. The same highly magnified and reversed, to shew its under side, with the mould adhering to the central fibrils.

Second Period.

Fig. 3. Represents the first frond evolving from the circular opening in the centre of the lobes, of the natual size. The circular opening is formed by the elevation merely of the central margin of the lobes, by the germinating frond.

Fig. 4. The seed-lobes reversed, to shew the true root.

Fig. 5. The lobes cut off, to shew the tuberous swelling of the young stem, with the young frond and root germinating from it.

Fig. 6. Shews the young plant with a second frond volving from the same part.

As to the difference asserted by Gærtner to subsist between the *vitellus* and *cotyledon*, having examined his supposed organ, and compared it with his own ecorded character, "*quod non extra seminis testam fferatur, aut in folium excrescat, sicuti cotyledones faere solent,*" &c.[‡], we are enabled to correct the error f this generally accurate observer. These lobes, in erns at least, so far from remaining within the testa f the seed, gradually expand, from an apparent point o the diameter, in general instances, of above a quarer of an inch. This is not the only case in which it is o be regretted that Gærtner should have confined his bservations to the first period only of the germinating rocess; during which, the peculiarities in the strucure of the embryo are seldom fully developed. If, herefore, mere terms, of which there are already too any, do not usurp the place of things, the seed-lobes f ferns possess not only an analogy with, but in fact artake of, the essential properties of cotyledons, so far these have been accurately defined. 1st, They conitute the body of their minute seeds. 2d, They inude within their substance the other organs of the mbryo, which they nourish, and, under the necessary circumstances, finally develope. 3d, As in the dicotyledonous seeds, these other organs germinate from a tuber situated in the centre of the lobes.

Although they differ in structure and manner of growth.

Yet notwithstanding this general congruity with dicotyledonous plants, ferns, both in the structure of their embryo and manner of germinating, possess characters clearly distinguishing them from all other plants hitherto described.

1st, In other dicotyledonous plants, the seed-lobes, at least such as rise to the surface, are afterwards farther elevated by the growth of the young stem; but this cannot happen in ferns, whose seed-lobes, less perfectly divided, and, expanding horizontally only, attain their full growth before the developement of the other parts of their embryo.

Temporary radicles.

2d, In other dicotyledonous plants, on the contrary, the root immediately germinating, contributes towards the evolution of the other organs of the embryo, and reciprocally, even to the expansion of the cotyledons themselves; whereas in ferns, previous to the shooting of the true root, the seed-lobes are nourished by minute fibrils, invisible to the naked eye, shooting from around the centre of the seed-lobes, and adhering to the soft mould in the crevices of moist rocks, where they frequently germinate. In this state, these plants, like the larvæ of many insects, have no similarity whatever to their future form, and must have been generally mistaken for young *Hepaticæ*, which, both in appearance and manner of growth, they somewhat resemble.

Seed-lobes cellular, without the vascular ramifications common to the other dicotyledones.

3d, In the seed-lobes of dicotyledonous plants, the vessels conveying the green juice towards the other organs of the embryo appear elegantly ramified, distinct from the deeper green of the cellular substance; whereas in ferns, on the contrary, the lobes of the cotyledon, when examined by the microscope, seem to consist entirely of a network of deep green cellular substance, without the least vestige of ramified vessels.

By these peculiarities, then, the true ferns are characterised with much more precision, than by the circinate involution of their fronds; a form of vernation which is common to them, with certain kindred tribes, such as the *Botrychiaceæ*, *Cycadaceæ*, *Lycopodiaceæ*, and *Marsiliaceæ*, as we shall afterwards find.

II. *Of the developement and peculiar Structure of the Stem of Ferns.*

General view of the developement and structure of the stem in dicotyledonous trees.

Although, therefore, the filices, in the organs of their embryo, possess a certain degree of analogy with dicotyledonous plants, this analogy diminishes as the process of germination advances. On cutting across the stem of dicotyledonous trees at the end of the first summer, three distinct parts are manifest; the bark enveloping the whole, a thin circle of wood immediately under it, and in the centre a great proportion of spongy cellular matter. The young stem thus formed resembles a cone, whose summit is terminated by a bud. During the succeeding seasons, the stem preserves its original shape, only the summit of the cone is extended, and its diameter enlarged; and on cutting it across now, we find the proportion of wood greatly increased, and that of the central spongy matter diminished, while it is horizontally radiated through the wood towards the circumference of the section. The origin of branches in these trees, is effected precisely in a similar manner.

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[*] *Beyträge zur Naturkunde*, iii. 75.

[†] *Anleit.* (Transl. 1807, Lond.) Pl. II. Fig. 17.

[‡] *De Fructibus et Semin. Plantar.—Præf.* 147.

A lateral bud is evolved from the bark, whose centre is produced from the radiated cellular matter of the trunk, surrounded with spiral sap-vessels; and a cone of wood is in like manner formed around it, whose base, during the first season, is gradually encircled by a layer of the contemporaneous maternal wood.

During the second year, therefore, the base of the young shoot can receive no addition to its proper diameter, except where it is unencumbered by the wood of the trunk: so that at its origin, a branch resembles the summit of an inverted cone, enveloped by the circles of maternal wood.

Opinions of Malpighi and Grew.

As to the order of the developement of the various parts of the stem, Malpighi supposed, that the internal circles of bark were subsequently condensed into wood; while Grew concluded, that the young wood was elaborated by the bark.

Experiment of Duhamel.

But the well-devised experiment of Duhamel demonstrated, that the bark itself, as well as the young wood, derive their origin from the gelatinous part of the sap, (the cambium,) exuding from the central and radiated cellular substance, in which new sap-vessels are developed annually during the season. The experiment of Duhamel alluded to, consisted in removing completely the bark of a cherry-tree, from the trunk of which he afterwards observed the sap oozing, and forming a new bark, under which new circles of wood were afterwards formed.

We are aware, that the accuracy of this experiment has been lately called in question by Palisot de Beauvois, in a memoir read before the Institute of France, who observes, that when a portion of the bark of a tree is removed, and the part from which it is taken is well rubbed, so as to leave no remains either of bark or cambium, neither the young nor old wood produce any thing, but that the edges of the divided bark extending over the bare wood then produce new wood, which unquestionably is derived from the former bark.

Palisot de Beauvois' experiment inconclusive.

But it does not seem that this experiment of M. de Beauvois invalidates the truth of M. Duhamel's conclusion; on the contrary, it is perfectly reconcilable with it. The efforts of nature are by no means limited to one mode of effecting her purpose. In fact, in both experiments the bark was formed from the cambium, from which the bark first, and subsequently the new wood, derive their origin; but in De Beauvois's experiment, the cambium oozed from the trunk covered with the remaining bark; whereas in Duhamel's, it necessarily exuded from the bare trunk.

It ought to be mentioned to the credit of Malpighi, that Duhamel's experiment partly confirmed the sagacity of his opinion, "Conquitur itaque in horizontalibus utriculis et medulla ipsa succus, ut futuris et proxime erupturis gemmis, et tenellis foliis Præsto sit."* For it is evident that the increased diameter and elongation of these plants depend on the same cause, viz. the annual expansive motion of the sap in the lymphatic vessels and cellular substance of the stem, and the subsequent formation and condensation of both into bark and wood, assimilated probably by the proper juices of the respective plants, prepared by the leaves, and distributed through the descending vessels.

From this general view of the manner of growth and organization of the stems of dicotyledonous trees, we shall perceive how remarkably they differ in both from ferns.

Second period of the germinating process in ferns.

The *second period* of the growth of these plants may be said to commence, when the seminal lobes, having attained their full size, a circular opening appears at the point of their union, in the centre of which the first frond may be perceived in that state of involution which is common to ferns with other kindred tribes. Even at this early period, the frond is at once distinguished from the seminal lobes. It is of a paler green colour, and with the stipes of a triangular form, in several species resembling the letter r, and, with the microscope, vessels may be seen elegantly ramified, diverging from the central stipes in every direction; whereas, in the seminal lobes, which are cellular and of a darker green hue, no ramified vessels can be distinguished. The temporary fibrous radicles of the seminal lobes, as well as themselves, now no longer of use, begin to fade, and their dark green sap being evidently absorbed for the nutrition of the young plant, from the tuberous stem of which the true root now descends exactly as in dicotyledonous plants. A second frond is soon perceived shooting from the axil of the first, and opposite to it, but with an additional lobe. In the same manner the fronds are thus evolved one after another, with a gradual addition to the number of lobes; the stem, during this period, acquiring only a slight addition of diameter, without any perceptible increase of length. Another circumstance to be remarked in the economy of these plants, is, that even during the second year, the stems, at least of the native European species, frequently germinating in the crevices of our sandstone cliffs and Gothic ruins, are very far from attaining their utmost diameter. It is no doubt probable, that the slow growth of these plants must be greatly influenced by their situation and soil, as well as by the temperature of our northern climate, but ill adapted to foster the growth of plants, which only attain their full perfection in the luxuriant forests of the tropics. Were it, however, admissible, under circumstances where observations are greatly deficient, to derive the grounds of probability from analogy, it is probable, that even under circumstances the most favourable, ferns do not attain their utmost diameter during several successive seasons; and it would seem that these plants possess a singular analogy with palms, in this and other respects.

PLATE CCLIV. Fig. 1, 2, 3, 4, 5.

Analogy the growth of ferns with palms.

Both Kæmpfer and Daubenton have remarked, that the *Phœnix* or date-palm, and others of this series, require several years before they acquire their utmost diameter; and that previous to this period, their stems do not begin to elongate, nor do their fronds acquire their perfect form and size. Now, in all these circumstances, they greatly resemble ferns. We know it has been frequently alleged, that certain species of ferns are stemless; an opinion countenanced by Sprengel, who observes, that "in this case the fronds issue from the tuber or root;" but having closely examined this supposed root, in the *Davallia Canariensis*, *Polypodium aureum*, and other species asserted to be stemless, we found that they possessed the structure and all other properties of procumbent stems, detaching at intervals proper fibrous roots, and diverging branches, and like the arborescent species, producing fronds from the numerous buds at the extremity. Whether certain species, however, are altogether destitute of stems, it is impossible to determine with certainty; but such a circumstance is very improbable, and it is far more likely that such as are thus figured by Plumier and others, are plants in the second period of their growth, whose elongation had not yet commenced. It is certain, however, that the smallest of our native species possess real, though very short stems.

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* *Anatom. Plant.* passim, et de *Caudicis Augmento*, p. 20.

Filices.

Prostrate species more prolific in buds.

These prostrate species form a singular contrast with those of the upright arborescent ferns. The *Cyathea arborea*, *C. aspera*, and other erect species, rival in magnificence the most lofty of the palms; yet, in the economy of their reproduction, these humble species certainly surpass them, being much more prolific in buds.

Third period in the growth of ferns.

When the stems of these plants have attained their utmost diameter, they may be said to have arrived at puberty. The *third period* of their growth commences. The stem now gradually elongates, but except where it ramifies, invariably in a direction parallel with the axis of the great vascular fasciculi; and Sprengel is incorrect in supposing the buds of the tuberous stem to be involute or circinate, like those of the fronds which germinate from it. These, in fact, consist of a round tuberous substance, of the same structure from the beginning as the material stem, extending longitudinally only.

Stems not circinate, as supposed by Sprengel.

The fabulous Baromez or Tartarian sheep.

The ridiculous fable of the old compilers of herbals, concerning the Baromez or Tartarian sheep, was long ago shewn by Linnæus to have originated from the singular appearance of the tuber of a species of fern (*Aspidium Baromez*, Willd. *Sp. Plant.* 110) covered with the brown woolly scales, common to many of these plants. It is certain, however, that the numerous ramifications of the prostrate stems, must necessarily prevent the growth of neighbouring plants, although they do not actually devour them like this chimerical sheep of the Tartars.

From the extreme slowness with which both ferns and palms arrive at an adult state, may we not presume that both partake of that longevity which it is well known palms possess, individuals of which are known to have existed above a century? With respect to ferns, indeed, few of which are necessary to the wants of mankind, no observations, as to this circumstance, are recorded.

In tracing the organization of the stem of these plants, the accuracy of Malpighi is again manifested; for, to this excellent observer, we owe the first notice of their general structure. In a figure of a horizontal section of the stem of a fern, he exhibits the distinct fasciculi of spiral vessels, surrounded with cellular matter, "Dispersis," he observes, "fibrosis fasciculis, et spiralibus fistulis compaginatur, ambientibus hinc inde, utriculorum seriebus."

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e.

Of modern naturalists, Sprengel has given by far the best view of the structure of the stem of these plants, accompanied with figures highly magnified, of the central fasciculi of Malpighi. But however valuable an analysis of these parts be when thus exhibited, we have preferred an illustration of the general structure of the stem itself, as it appears when attentively examined by the naked eye, as affording a more correct outline, not only of the general structure, but of the relation the several parts of the stem bear to each other. Sometimes, indeed, it would seem, that confusion is produced by too high a magnifying power; and the subject intended to be represented, is rather obscured than clearly delineated, a circumstance which seems well illustrated by the highly magnified view given by Desfontaines, of a transverse section of the stem of a fern, in an excellent Memoir on the organization of monocotyledonous plants.* In order to have the view of the parts as distinct as possible, it is necessary to cut the stem across, at a distance from the lateral buds.

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Fig. 7. represents a transverse section of the creeping stem of *Aspidium filix mas*; and Fig. 8. a longitudinal section of that of *Davallia canariensis*. In tracing the origin of the buds of these plants, it is clear that they originate from the cellular substance of the centre swelling, and in a manner forcing the vascular fasciculi to accompany them in a lateral direction.

Plate CCLIV.

Fig. 7. *a*, The exterior cellular substance, part of which, in the stems of the great arboresent species, is externally converted into a substance of the density of horn, which is sometimes furnished with spines, but is, for the most part, in young plants, covered with woolly scales, each of which is furnished with a central fasciculus probably vascular, issuing from a pore in the surface of the stem. These scales serve partly the purpose of bark, in protecting the young shoots, and evidently prevent the evaporation of the fluid part of the sweet juice which every where envelopes the germs of the future fronds and stems, which, in our northern climate, remain dormant during winter. The central cellular matter in ferns (Fig. 7. *b*) is not converted into wood, as in decotyledonous trees, but remains soft and spongy, in the stipites at least, till finally absorbed during the ripening of the fruit. This substance abounds with a similar saccharine juice, often accompanied with an unpleasant astringency. The stem and branches of these plants are entirely cylindrical, unless accidentally checked in their growth by removal into an unsuitable soil, whereas the stem and branches of dicotyledonous trees are invariably conical, tapering towards the extremity.

Saccharine mucilage common in the stems of ferns.

Cylindrical, and not conical like the stems of dicotyledonous trees.

Fig. 7. and 8. *c*, The roots in the procumbent species, issuing from the cellular substance, and descending into the soil, from the under side of the stem, opposite the germinating buds. Each of these shoots, therefore, when detached, form so many distinct plants, possessing the full diameter of the adult stem, and, like those mentioned by Kæmpfer, occasionally shooting in the same manner, from the stem of palms, attain speedily their perfect form. It was, I believe, Micheli who first described the calyptres or covers on the extremity of the roots in certain aquatic plants. Sprengel has observed these covers on the extremities of the fibrous roots of ferns, and supposes them to be organs of absorption, in some degree analogous with the ampullæ in the villous coat of the intestinal canal of animals. To us, it would seem probable, however, that these covers, like the chaffy scales of the stems and fronds, are intended rather to protect the delicate extremities of the absorbent roots, than to perform this office themselves.

Calyptres of the fibrous roots.

III. *Of the Fronds and parts of Fructification of Ferns.*

The buds from which the fronds of these plants are evolved, form part of the great central tuber from which the stem itself is produced. This tuber, in our northern climate, is found during winter, surrounded with the decayed stipites of the fronds of the preceding season, and closely invested with the woolly scales already mentioned. In examining these buds separately, we find that it is the superior part or frond only which is involute, or circinate, as it is termed; the stipes itself being extended nearly in a straight line, from its origin within the stem. In the *Aspidium filix mas*, we have traced the diverging vascular fasciculi within the stem, before the external developement of the fronds; and this appears evident in some species on cutting it across, when the large central fasciculi of the stem appear surrounded with the smaller ones of the stipites of former years, (Fig. 7. *d*). The reason these are not perceptible in the section of the stem, represented in Fig. 8.

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* *Memoires de l'Institut National*, tom. i. p. 478, by Desfontaines.

The fasciculi of the stipites may be traced within the mature stem.

ut supra, is, because it is difficult to recognise them in the young succulent stem, as distinct from the cellular substance. The term *lignum fasciculatum*, used by Daubenton and Desfontaines to designate the stems of monotyledonous plants, is in fact peculiarly applicable to the mature stem of ferns. For these fasciculi may be seen even by the naked eye, and traced from their first divergence within the stem, to their final termination in the veins, as they are termed, of the frond, in many instances in contact with the groups of capsules.

Sprengel's hypothesis concerning the fecundation of the seeds.

Sprengel had the merit of first pointing out this circumstance; and he supposes "the vascular fasciculi contain the concentrated sap, analogous with the proper juice of other plants, which is elaborated in the thick solid tubers of ferns, from the humidity of the earth absorbed by the roots. The oxygen of the carbonated water entering the loose cellular texture, while the carbon, uniting with the hydrogen, is conveyed into the ascending spiral vessels, where it contributes to the formation of the fruit, while the brown membrane surrounding the fasciculi, prevents the admixture of the elaborated sap with the crude juice of the cellular texture.—This construction," he adds, "throws light on the peculiar origin of the seed-vessels in these plants, which takes place immediately from the ribs of the frond, or the continuation of the spiral vessels."

Fronds, their analogy with the leaves of other plants.

It is very probable, that the vascular fasciculi perform an important office in the formation of the parts of fructification in ferns; but it is equally so, that the fronds, like the leaves of other plants, contribute their part in the assimilation of the saccharine mucilage contained in the cellular substance of the stem, which would seem destined, not only to the nutrition and evolution of the infant germs invariably imbedded in it, but to the developement of the fruit itself. What renders this opinion more probable, is the circumstance, that the abundance of the saccharine matter increases or diminishes with the health or weakness of the respective plants, and in the autumn after the ripening of the seeds, it is exhausted, and the cellular matter itself partly disappears, and the central part of the stipites is found hollow. However, an abundant supply is deposited in the stem for the use of the buds the following season. In short, this saccharine mucilage seems to possess a remarkable analogy with the cambium of Duhamel, from which, in other plants, both buds and seeds are apparently developed, and subsequently nourished and perfected.

Although in by far the greater number of species the buds are produced from the stem, there are many others, as *Polypodium reptans*, in which buds are evolved from the top of the frond. Indeed in their general structure, the stipites of the fronds possess a considerable analogy with the branches of other plants; but they also combine with this the properties of leaf and fruit-stalks. There are, however, some species, as *Schizæa dichotoma* of Smith, and *S. bifida* of Willdenow, whose stipites are destitute of frondose expansions.

The fronds in the whole series are generally green, except in the under surface, which is white in one *Acrostichum* and in *Cyathea dealbata*, and other species, whilst it is of a beautiful yellow in *Acrostichum sulphureum*.

The young buds, both of the stem and fronds, are often beset with scales or hairs, and sometimes this is the case with the under part of the expanded fronds. It is singular, that Hedwig should have mistaken these hairs in the infant fronds for antheræ; so very apt are men of the first talents to hunt after analogies where none can possibly exist.

And peculiar elegance.

If we except the magnificent palms, no plants are really more ornamental than ferns. To them, indeed, we are not attracted by the fine colour or perfume of the flower; but, even in our northern climate, there is a peculiar freshness and beauty in the bright green hue of the arched frond and elegantly divided pinnulæ of the Brake and Polypody. No plants are better adapted than these to adorn the sloping bank of the clear and pebbly stream; and their beauty in such situations has not been overlooked by the fine taste of one of the first poets of our time:

> Where the copsewood is the greenest,
> Where the fountain glistens sheenest,
> Where the lady fern grows strongest,
> Where the morning dew lies longest.

The number of ramifications of the vascular fasciculi differs greatly in the numerous species. In the *P. aureum*, a single branch turns at a right angle into the pinnulæ; whereas in the more complicated frond of *Davallia canariensis*, and others of a like form, several ramifications accompany the respective subdivisions of the frond; and towards the end of autumn, in our native species, a skeleton of the ligneous fasciculi can be dissected from the surrounding cellular matter, through the minute ramifications of the frond, almost to their apparent termination in the groups of capsules. In several species, these vessels swell at their extremity into knobs; a circumstance that gave rise to the hypothesis of Bernhardi, who supposed them to be the male organs;* but, unfortunately for this hypothesis, it has since been observed by Sprengel, that the supposed organs are wanting in many species; but where they do exist, he admits that the minute vermicular bodies contained within them are probably receptacles of the concentrated juices of the veins, which, according to his own hypothesis, perform the chief part in the process of fecundation.

Various
potheses
specting
antheræ
ferns,

Other parts in the frond have, however, by various writers, been supposed to perform this important function. Micheli, whose accuracy in other respects is well known, attributed the office of antheræ to the capillary productions, which he discovered on the unevolved fronds; and, as already observed, Hedwig adopted and illustrated this opinion, (*Theoria Gen. Pl. Crypt.* tab. v. vii.) Gleichen considered these organs to be situated in these minute fissures, on the lower surface of the cuticle of the frond, which are well illustrated by Sprengel (T. ii. fig. 14.) in his work on cryptogamous plants; whilst Kölreuter assigned this office to that production of the cuticle of the frond, which, in most of the tribes of ferns, forms the involucrum of the groups of capsules. But leaving these various hypotheses to their natural fate, it is full time to proceed to the consideration of the capsules themselves.

Equal

The singular aspect of these plants, which every one observed to spring up in wild and uncultivated places, without any visible seeds, seems to have given rise, in an age of general ignorance, to those superstitious fancies formerly prevalent in several parts of Europe. It was a practice among the people to collect the capsules, which they considered as the seeds of ferns, on midsummer eve, and make use of them in various charms. "We have the receipt of fern seed," says Gadshill, in Shakespeare's Henry IV. "we walk invisible." In fact, the botanists of the sixteenth century partook in the faith of the times. Valerius Cordus, in his commentsries on Dioscorides, Tragus, and Baptista Porta, ignorant of the existence of the capsules, all agreed, that the powder found on the lower part of the frond produced plants. Cordus, however, contended, like some of the present time, that this powder could not be true seed, because the plants were destitute of flowers; and although Morison long afterward (*Hist. Pl.* P. iii. sect. xiv. p. 593.) observed and described the germinating plants of the *Osmunda regalis*, it is clear that he was unacquainted with the seeds being contained in capsules. It is singular, that Malpighi (*Anat. Plant.* p. 72. tab. 51) Grew, (*Anat. of Plant.* tab. 62) and Swammerdam, (*Bibl. Nat.*) should have discovered the true nature of the ruit nearly at the same period.

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* Schrad. *Journal für die Botanick.*

These capsules have been traced by Sprengel and Bernhardi, from their first developement in the young ucculent frond. They appear, when young, mixed vith filaments, which at first these eminent naturalists magined to be the male organs; an opinion which the enuine candour of Sprengel speedily relinquished for that lready stated, viz. that the impregnation is effected by he concentrated proper juice contained in the ascendng vessels of the fasciculi. We have already stated, that ve cannot consider this process of fecundation to be efected solely by these vessels;—why should we attempt o limit, by imaginary analogies, the operations of naure? Bernard de Jussieu long ago (*Mem. de l'Acad. des Sciences*, 1740) demonstrated the male organs of the *Marsiliaceæ* (a tribe possessing evident affinity with the erns,) within their capsules. Now, although such orans have not hitherto been detected within the capsules f ferns, there seems nothing really absurd in conceivng seeds to be formed within these capsules, and perected by the absorption not merely of the ascending ap from the vascular fasciculi of the stem and frond, ut from veins returning the sap elaborated in the retiular substance of the expanded fronds. That the sap hus returns from the fronds is highly probable, from e green colour of the saccharine mucilage, a superbundance of which, we have already observed, is annully deposited for the developement and nutrition of fuure germs in the stem itself.

Plate CCLIV. Fig. 9. represents a pinnule of *Athyum thelypteris*, as delineated by Schmidel, in order to ew the elegant ramifications of the vascular fasciculi, contact with which the groups of capsules appear, overed with their respective involucra. Fig. 10. a ghly magnified view of one of these, with the yellow obular bodies, imagined by Bernhardi to be male orns. Fig. 11. a capsule with its ring, beginning to urst and eject the seeds.

These figures, then, although representing the fruit the *Aspidiaceæ* only, we shall refer to as types of the spective fruit of the whole series of ferns.

The groups of capsules are termed *sori*, from σωρος, *ulus*. In many genera, these groups are covered with involucrum, as represented in the Figure; but in hers they are quite naked. This involucrum is evintly a production of the cuticle, and, in its early te, is organised exactly in the same manner.

GENERAL ARRANGEMENT OF FERNS.

Previous to the excellent paper of Dr now Sir James ward Smith, published in the fifth volume of the *Mers of the Academy of Sciences at Turin*, our knowledge he genera was very imperfect; but this celebrated anist, by a more accurate examination of the species, enabled to reform the genera, and to reduce them, from a state of comparative confusion, nearly to their present form. Since the work of Smith, others have followed on the same principle; and Bernhardi, Swartz, and Sprengel, have respectively contributed to our stock of knowledge of these plants.

The general principles on which the genera are at present distinguished, consist in the form, attachment, and manner of opening of the involucrum; and when this envelope is wanting, in the manner in which the *sori* (groups) are arranged on the receptacle of the frond. To the receptacle, the capsules are generally attached by a fruit-stalk, in some so short, as to cause them appear sessile; in others of a considerable length, and sometimes branched with a capsule on each division. The receptacle, whether situated on the plane of the frond, or elevated above it, is in by far the greater number of known genera common to a numerous group of capsules, although, as will soon appear, there are instances of single multilocular seed-vessels apparently sessile in the frond itself. The capsules in most of the tribes are girt with a ring, which, on the maturity of the seeds, breaks, and springing backwards, ejects them with considerable force to some distance from the plant. This circumstance may be observed occasionally, by placing the ripened groups under the microscope, with a sheet of writing paper under them to receive the exploded seeds. In a great part of the series, many of the genera want the rings; but, instead of them, their capsules are more or less marked with striæ, in the direction of which they burst.

An attempt is here made to arrange the genera on the principle of the natural method, as far as our limited knowledge of the structure of their most essential organs would admit. It is no doubt very likely, that several of those we have ventured to approximate, will be found deficient in affinity by subsequent observers; but as an adherence to truth and nature is the great object, this will only add to our satisfaction; conscious, as the illustrious Jussieu observes, that such errors originate "Non legum naturalium, sed pravæ eorum interpretationis, vitio."

I. DANÆACEÆ. (Plate CCLIV. Fig. 12. *a.*)

(*Poropterides*, Willd. *Sp. Plant.*)

We have commenced with this singular tribe, because although it differs most remarkably from the rest of the series, it is still more nearly related to them than the *Marsiliaceæ*, *Lycopodiaceæ*, and *Gonophytaceæ*, of which an account will be afterwards given in the proper place. The single multilocular seed-vessels, in this tribe nearly sessile in the substance of the frond, and which, in the genus *Marattia*, are endowed with a divisible septum, renders it necessary to arrange them in a natural method, distinct from the other known tribes of ferns. Indeed, their solitary seed-vessels possess neither an involucrum nor ring, yet their fronds are entirely those of ferns. They possess a similar structure. They are involute, or circinate as it is termed, in their vernation, and affect a similar pinnate form; but in their fruit they are singularly distinct; for instead of the groups of minute capsules, as in the greater part of the series, this tribe is furnished with multilocular seed-vessels imbedded in the substance of the frond itself, and opening, when ripe, in pores on the surface, leading to the respective loculaments.

Genera.

(1.) ***Marattia.*** (Sm. *Act. Taur.* 5. p. 419. *Myriotheca*, Juss. *Gen. Pl.* p. 15. Willden. *Sp. Pl.* 5. 1942.)

Seed-vessels oval, distant, with a divisible or double septum, and a row of cells, opening on each side, in transverse, linear, or ovate pores.

The cells of the seed-vessel are arranged on each side of the double septum to the number of five or six. Of this singular genus there are four species known, two of which are described by the indefatigable Swartz, natives of the West Indies. These two species are figured by Smith, viz. *M. alata* and *M. lævis*. The other two are natives of Isle de Bourbon; the *M. fraxinea*, also figured by Smith, (*Icones ineditæ*, tab. 46, 47, 48.) and the fourth species greatly resembling the last; but this species (*M. sorbifolia*) has alternate, instead of opposite pinnæ of the fronds. We are indebted to Swartz for an excellent figure of the generic character. (*Flor. Ind. Occident.* iii. tab. 29.)

(2.) *Danæa.* (Sm. *Act. Taur.*)

Seed-vessels narrow, linear, transverse, parallel to each other, imbedded in the substance of the frond. Cells in a double row, opening in pores.

Linnæus referred the only species known to him to *Asplenium*, the oblong single seed-vessels somewhat resembling the groups of capsules in that genus, when superficially observed. There is a good figure of the generic character in the *Annals of Botany*, ii. Pl. 10. Three species are described by Willdenow, all natives of America, viz. the *D. simplicifolia*, (Rudge, *Pl. Gujan.* tab. 36.) *D. nosa*, (Plum. *Pl. American.* tab. 6.) and *D. alata*, (*Plum. Fil.* tab. 109.)

II. GLEICHENIACEÆ.

The genera of this tribe approach much nearer to the majority of the series than the last. The seeds are contained in minute capsules arranged in groups, and are unilocular, striated, and sessile. The striæ are transverse or oblique, and the capsules burst longitudinally in the direction of the striæ. The groups are naked, and, except in *Mertensia*, have a very limited number of capsules.

Genera.

(1.) *Angiopteris*, (Willd. 1944.)

Capsules elliptical, disposed in groups of five or seven, in double rows, along the secondary veins of the frond, and opening longitudinally.

There is but one solitary species, the *A. evecta*, hitherto known, figured by Hoffman, (*Comm. Gœt.* p. 29. tab. 5.) This species was brought from the islands of the South Sea by Forster; and Swartz has represented the generic character in the *Annals of Botany*, Pl. 10. fig. 4. This species is five feet in height, and has the aspect of a small palm.

(2.) *Gleichenia*, (Sm. *Act. Taur.* 5. p. 419. T. 9. Fig. 10. Willd. *Sp. Pl.* 5. 1945.)

Capsules disposed in point-like groups of three or four together.

In this genus, the lobes of the frond are rolled backward; and the *Gl. polypodoides* was ranked by Linnæus under *Onoclea*, without regard to the want of a ring. *Gl. polypodoides* is a native of the Cape of Good Hope, and with two others, viz. *Gl. circinata*, and *Gl. glauca*, is described by Willdenow and Swartz. To these Brown has added six more new species, none of which are yet figured. (*Prodr. Nov. Holl.* p. 160.) The *Gl. hermanni* is the *Mertensia dichotoma* of Swartz, and *Dicranopteris* of Bernhardi. In *Gleichenia* the fronds are dichotomous.

(3.) *Platizoma.* (Brown, *Prodr. Nov. Holl.*)

Capsules sessile, mixed with powder, and in distinct point-like groups.

Mr Brown observes, that this genus is scarcely distinct from *Gleichenia* in fructification, but it differs in having the stipites simple.

(4.) *Mertensia.* (Willd. *Act. Holm.* 1804, p. 165.)

Groups or sori round; the capsules numerous, semibivalve.

This genus was formerly, like many others, confounded with *Polypodium*. The species are all natives of tropical climates, and fully described by Willdenow and Swartz; and several of the species are figured in the *Act. Holm.* tab. 4 and 5. He enumerates eleven species, including the *Gl. Hermanni*, under the name of *M. dichotoma*. Two species were discovered by Humboldt in the arid territory of New Andalusia, namely, *M. glaucescens* and *M. pubescens*.

III. OSMUNDACEÆ. (Plate CCLIV. Fig. 13.)

In this tribe the capsules are very numerous, and, except in *Osmunda*, sessile, elegantly striated, generally in the form of rays on the top, and being pellucid, they appear finely veined when examined by the microscope. Like the *Gleicheniaceæ*, their capsules burst longitudinally. They have not dichotomous fronds like most of the genera of that tribe.

Genera.

(1.) *Todea.* (Willd. 1947.)

Capsules globular, semi-bivalve, on the transverse veins of the frond.

There is but one species only, the *T. Africana*, described and figured by Willdenow, (*Act. Acad. Erfurd*, tab. 3.) and by Plukenet, (*Alm.* tab. 181. fig. 5.) This is the *Osmunda barbara*, (Thunb. *Prodr.*) but, according to Brown, *Todea* ought not to be considered as a genus distinct from *Osmunda*, as it possesses pedicillated capsules.

(2.) *Mohria.* (Willd. 1948.)

Capsules somewhat round, dispersed, opening in an oblong pore at the side, the crenulated margin of the lobes bent in upon them.

There is but one species, the *Thurifraga*, as yet known. (Vid. Swartz *Synops.* tab. 5.) *Osmunda marginalis*, Lamarck, *Encycl.* iv. p. 612. *Osmunda thurifraga*, Bory. *Itiner.* i. p. 348.)

(3.) *Hydroglossum*, Willd. 1949. (*Ophioglossum*, Lin. *Sp. Pl. Lygodium*, Swartz. *Synops.* Br. *Prodr. Nov. Holl. Ramondia*, Juss. gen. *Odontopteris*, Bernh.)

Capsules sessile, ovate, inserted by the middle in double ranked spikelets, issuing from the margin of a pinna or frond, covered with a scale, and opening longitudinally.

For a fine figure of this singular genus, we are indebted to Sprengel, (*Crypt.* Plate V. fig. 39.) Linnæus confounded it with *Ophioglossum*, with which it certainly has no affinity whatever.

To the accuracy of Brown we are indebted for the first notice of the singular insertion of the capsules into the receptacle. The most correct character of the genus is given by Brown and Swartz, which is here preferred to that of Willdenow, (*Sp. Pl.* 577,) wherein he describes fifteen species, among which the fourth, *Hydroglossum hastatum*, is the *Lyg. venustum* of Swartz. This beautiful fern (figured by Breynius, tab. 96; Petiver Gazoph. tab. 64; and Morison, sect. 14, tab. 3,) is a native of Brazil. It is distinct from the *Hyd. scandens*, of which it was supposed to be only a variety. The stem is round and sarmentous, the frond tripinnate, the last of the pinnulæ serrate, and the extreme lobe much extended. The whole plant is covered with woolly hairs. Willdenow reckons the scale investing each of the capsules, an involucrum, with which it would seem to possess no just analogy. As the *Hyd. scandens* is now in the collection of the Botanic Garden at Edinburgh, through the industry of the superintendant Mr Macnab, we shall now have an opportunity of examining the fruit more closely. Brown (*Prodr. N. Holl.*) observed the last species (*Ugena microphylla, Cavanilles,*) and a new species, the *Hyd. semibipinnatum*, in New Holland (vid. *Prodr.* p. 162.)

(4.) *Schizæa*, (Sm. *Act. Taur.* 5, tab. 9. fig. 9. Willd. *Sp. Pl.* 1950.)

Capsules oval, in two ranks, on the back of narrow appendages of the summit of the frond, opening laterally in an oblong pore.

Linnæus arranged this genus with *Acrostichum*, but it was justly separated from that genus by Smith. He gave it the name of *Schizæa*, from the gashed appearance of the fronds and their appendages. The radiated striæ of the capsules manifests its close affinity to the rest of the *Osmundaceæ*. Willdenow describes eight species, to which Brown has already added a ninth, *Sch. rupestris*. There are certain species, particularly *Sch. pectinata*, with a simple linear stipes, without the frondose expansion, which have an appearance singularly distinct from the generality of the series. Plukenet (*Almag.* p. 200, tab. 95.) accounted this a *juncus*, and he terms it *Juncus elegantissimus capitulis pectinatis*. In this he was followed by Ray and Morison. The other species, however, may be considered as only approaching to this uncommon form. From the capsules being in some degree concealed by the inflected margin of the appendages, others of the genus, as the *Sch. elegans*, might be confounded with *Onoclea*; but the absence of rings, at once, on proper examination, shews their true character.

(5.) *Anemia*, (Swartz, *Synop.* pl. Willd. *Sp. Pl.* 5. 1951.)

Capsules top-shaped, opening on one side, and arranged in spikes.

Of this genus Willdenow reckons seventeen species. It is very probable, however, that, on a more close examination, it will be found necessary to consider the four last as a distinct genus, their fruit-stalk, like those of *Botrychium*, rising from the ground; although, without the dissection of living specimens, it is impossible to ascertain this. The remaining fourteen species, several of which are correctly figured by Plumier and Petiver, are at once distinguished from these by their fruit-stalks, generally two, branching from the stipes, at the commencement of the frond; and, by this remarkable structure, as well as their sessile capsules, the whole are clearly distinguished from *Osmunda*, with which all of them were formerly confounded. In general, they are natives of South America. The *A. villosa*, (Willd. *Sp. Pl.* 5, p. 92.) which was lately discovered by Humboldt and Bonpland in South America, is a species quite distinct from *Osmunda villosa*.

(6.) *Osmunda*, (Willd. 1952.)

Capsules with footstalks, globular, semibivalve, opening at the striæ, and either situated on the back of the unaltered frond, or around it, when contracted into the form of a panicle.

Willdenow enumerates only seven species; but Brown, whose accuracy is unquestionable, thinks that *Osmunda barbara*, separated from this genus by Willdenow under the name of *Todea* (Willd. p. 76.), ought to be restored to it, on account of its pedicellated capsules; so that there are eight species known, of which one, the *O. regalis*, only is a native of the moist woods of Europe. The germination of the young plants of the last species was observed by Morison, and, from his very concise and imperfect description, it would seem probable, that in this process it resembles those whose capsules are furnished with rings.

The *O. spectabilis* of North America, though at first considered as a variety of the *O. regalis*, is supposed by Willdenow to be a distinct species, having pinnules finely serrated. Both, when planted in a moist situation, are very ornamental, growing to the height of five feet. The *O. interrupta* of Willdenow is the *O. basilaris* of Sprengel; and, like the *O. claytoniana*, bears its fruit towards the middle of the frond. The *O. cinnamomea*, *O. japponica*, and *O. lancea*, have their fruit-bearing fronds differently shaped from the barren ones; and may eventually be found a distinct genus.

The genus *Osmunda*, then, evidently does not bear its capsules on a separate spike, like the *Anemia*, but on the back of the fronds, which are changed in such a manner, in several of the genera, as to put on the appearance only of spikes. They approach, therefore, in their general structure, to those of the rest of the series, whose capsules are annulated; and to the ardour and diligence of Humboldt and Bonpland we owe the discovery of an intermediate link between the genera without rings, and those that have them, in

Polybotrya, (Willd. 1953. Humboldt and Bonpland.)

(Intermediate genus.)

Capsules with rings, sessile, round, aggregated in naked loose spikes.

There is but one species known of this truly interesting genus, *P. osmundacea*, which affords another, among many instances, of the fact, that the several links of the great chain of living natural bodies, are now, or were formerly, connected together, although we are generally only able to perceive them in that detached or disunited form under which we endeavour to characterise them in groups. The ferns, therefore, whose capsules are annulated, and those which are without rings, are not naturally distinct; and therefore we ought not to divide them into artificial classes, but endeavour rather, by tracing the organisation of individuals, to collect and approximate the various groups of kindred genera, and thus restore them, as nearly as possible, to the place they really occupy in the series of natural affinity.

IV. POLYPODIACEÆ. (Plate CCLIV. Fig. 14.)

In this tribe the genera have the capsules nearly surrounded with an elastic jointed ring, which, as in all the others endowed with them, bend backwards on the bursting (see Plate CCLIV. Fig. 11.) of the ripened capsule. In the whole of the genera, the capsules are naked, or at least apparently provided with no other covering than numerous hairs everywhere around them. Brown, however, whom it is impossible to mention without praise, has in one genus, hitherto supposed to belong to *Polypodium*, demonstrated that these hairs are in reality the divided margin of a singular involucrum, whose capillary segments are incurved so as entirely to conceal the young, and even the mature capsules, of the *Woodsia hyperborea* and *W. ilvensis*, so that this genus must be removed to the tribe *Cyatheaceæ*, (see p. 342). Whether similar involucra may not, some time or other, be detected in others of this very heterogeneous assemblage, future careful examination must determine.

GENERA.

(1.) *Acrostichum*, (Willd. 1954.)

Capsules covering the whole or the greater part of the lower disc of the fertile fronds, which frequently differ in shape from the barren ones.

Willdenow reckons sixty-two species, to which Brown (*Prodr. Pl. New Hol.*) has added two hitherto undescribed, the *A. fraxinifolia* and *A. pteroides*; the former species nearly related, he observes, to *A. aureum*, but different in having the pinnæ shortly accuminated. The *A. alcicorne*, previously described by Swartz, was observed by Brown near Port Jackson.

. The species of this extensive genus are too numerous, and differ too evidently in appearance, to be accurately known; and it is easy to see that they require a more natural subdivision than, from our present imperfect acquaintance with their structure, can as yet be attempted with success. Some of the species would seem to approach to *Onoclea* in affinity. Genera, however, totally distinct, have been confounded with *Acrostichum*, from being examined in an advanced period of their fructification. Hence, as Sprengel observes, *A. hastatum* and Liljebad's *A. alpinum*, are real *Polypodia*, their capsules becoming crowded when about to burst. In many of the species, the fertile fronds, contracting, put on the appearance of spikes, seeming totally distinct from the sterile ones; and thus have been, even by modern botanists, confounded with *Osmunda*. In the *Acrostichum alcicorne*, now in the public collection at Edinburgh, the sterile fronds are kidney-shaped, entire, and sessile; while the fruitful fronds are erect, dichotomous, wedge-shaped at the base, bearing their capsules towards the upper part, on the lanceolate laciniæ. This singular species is figured by Schkuhr, (*Crypt.* 1. tab. 2.) By far the greater part of the *Acrosticha* are natives of tropical regions.

The *Acrostichum maranta* is the only European species hitherto described. This species has opposite bipinnate fronds. The pinnules entire, oblong, blunt, united towards the point of the frond, the whole of which is in the back covered with chaffy scales, as in *Ceterach*, from which, however, it is easily distinguished, by comparing them when the *Ceterach* is in the first period of fructification, and the transverse lines of its capsules are clearly seen. The *A. maranta* is found on the rocks of Styria, in the Tyrole, Switzerland, Italy, Spain, and Portugal. The *A. canariense* possesses great affinity with *A. maranta*; but it differs in being, in every respect, of double the size, the lower pinnæ having nine or ten pinnules on each side, and the former being all alternate instead of opposite, as in *A. maranta*.

(2.) *Hemionitis*, (Willd. 1955.)

Capsules inserted into the reticulated vessels of the frond.

In this elegant genus, the fruit accompanies the ramifications of the veins, or rather vascular fasciculi of the frond. Willdenow describes fifteen species, in eight of which the frond is entire, and in the remainder variously pinnated. In the *H. acrostichoides*, the capsules are confluent on the broad, lanceolate, undulated, and crenate pinnæ. This species is a native of Sierra Leone. The *H. reticulata*, figured by Sprengel, is evidently allied to *Vittaria lanceolata*, with the groups of capsules in branched lines, with which Brown thinks it ought to form a distinct genus. The *H. rufa* is the *Acrostichum rufum*, (*Sp. Pl.* 2. Lin.) This species a good deal resembles the *Asplenium tomentosum* of Lamarck (*Encyc.* 2. p. 305.), from Brazil. The species are all natives of warm climates.

(3.) *Meniscium*, (Willd. 1956.)

Capsules in lunulated groups, situated nearly parallel to each other, on the transverse vascular fasciculi of the frond.

Only six species are at present (1815) known; and to Sprengel we are indebted for a correct figure of the generic character, in an engraving of the *M. triphyllum*, (*Anleit.* tab. 3. f. 20.) Schreber first characterised this genus, from its crescent-shaped groups of capsules situated on the ternary ramifications of the frond. The *M. tryphyllum* is a native of the East Indies and of China. The most remarkable of the species was discovered lately by Humboldt and Bonpland in New Andalusia, the *M. arborescens*. The stem of this fern is erect, and upwards of eight feet high; fronds pinnated, eighteen inches long; pinnæ lanceolate, wedge-shaped at the base, two or three inches long, alternate, nearly sessile, and more or less sinuated; the stipites smooth, green, about a foot long, and trisulcate above. This species possesses great affinity with the *M. reticulatum*, and with it probably will be found to constitute a distinct genus. The *M. reticulatum* is figured by Petiver (tab. 6. fig. 13.) It has not an erect stem. The *M. sorbifolium*, in its fronds, also resembles the *M. reticulatum*, but the pinnæ are uniformly far more narrow and acuminated. It is the more useful to note these external resemblances, as they frequently point out the link of affinity in the genus. It is singular that Jacquin should have considered the last species as an *Asplenium*, (*Collect.* 2. p. 106, tab. 3. f. 2.) Both are found in Martinique; indeed, all of them, except the *triphyllum*, which is a native of the East Indies, are found in the West Indies and South America.

(4.) *Tænitis*. (Willd. 1957.)

Capsules generally in linear, longitudinal, and continued groups, situated between the middle fasciculus and exterior margin of the frond.

This curious genus was formerly by Willdenow supposed to belong to *Pteris* (*Phytog.* tab. 9.) but it was very properly separated from that genus by Swartz, under its present designation. In fact, neither of the species, of which there are only two known, could be reckoned *Pterides*, as in neither do the fronds furnish an involucrum which is essential to that genus. Sprengel has a good figure (Pl. 10 *Anleit.*) of the generic character, in a pinna of the *T. blechnoides*. (See also Willdenow, *Phytog.* tab. 9.) The affinity of this genus with *Grammitis* is singularly evident, and it is better to refer such species as have the interrupted lines of capsules to that genus.

(5.) *Grammitis*. (Willd. 1959.)

Capsules in groups of longitudinal interrupted lines beset with scales, (Sprengel.)

This genus can scarcely be distinguished from the last, unless by the lines of capsules in them being straggling and interrupted, and nearly covered by scales. The greater part of the species known, have simple linear or lanceolate fronds. The *G. pumila* has linear filiform fronds, and a solitary line of capsules towards the point of them, along the middle fasciculus, or vein as it is usually termed. This can only be seen by a magnifying glass, (Swartz). The frond of the *G. elon-*

gata, figured by Sprengel, (Tab. 3. *Anleit.*) exhibits the character of this genus. To the fifteen species described by Willdenow, Brown has added two others from New Holland, viz. *G. Australis frondibus lanceolato linearibus obtusiusculis, integris, glabris*, and *G. rutæfolia.* Of those with compound fronds, the *Leptophylla* is figured by Cavanilles (*Ann. Sc. Nat.* t. 41. mala.) as an *Asplenium.*

(6.) *Ceterach.* (Willd. 1958.)

Capsules in transverse linear groups.

The *Ceterach* has been so frequently described under different generic names, that it would seem to have puzzled the most eminent botanists. The *C. officinarum*, which is a native of Britain, and most countries in Europe, has had the various names of *Asplenium, Scolopendrium*, (*Flor. Brit.* 3. 113. and *Roth. Germ. Grammitis*, Swartz,) and now Willdenow has considered it as a distinct genus, along with two other species, the *C. canariensis* and *C. aspidioides*. This last possesses the frond of *Athyrium thelypteris*, whilst the groups of capsules resemble those of *Asplenium*, without the involucrum. The transverse position of these groups sufficiently divide it from *Grammitis*; yet, like it, this genus has the capsules beset with scales. In both, however, these scales have no affinity with involucra, so far as yet discovered.

(7.) *Northolæna.* (Br. *Prodromus Nov. Holl.*)

Capsules in continued or interrupted marginal groups, beset with scales or hairs.

Of this genus, Brown describes three species from New Holland. The *N. distans, N. vellea*, and the *N. pumila.* Besides the above, he observes, "huc pertinent Acrostichum marantæ, Pteris trichomanoides, et aliæ nonnullæ ineditæ," (Vid. *Prod.* p. 145.)

(8.) *Polypodium.*

Capsules in round distinct groups, in rows; more or less distant from each other.

The expediency of an accurate revision of this vast genus, which, by its present character, includes, according to Willdenow, a hundred and fifty-six species, is become obviously necessary. Can it be doubted that, in such an assemblage, differing so evidently in their structure, genera entirely distinct are necessarily included? The genus *Polypodium*, Brown justly observes, forms at present above a seventh part of the whole series. It is therefore much to be regretted, that the most eminent botanists of the present period, with some remarkable exceptions, are rather indisposed to that close and unwearied investigation of individuals,—that patient and close inquiry into the structure of the fruit and seed, which are more than ever become indispensable to the accuracy of arrangement, not only of these, but of plants in general.

Since the judicious exclusion of *P. arvonicum*, (*Flor. Brit.* 111. 115; *P. hyperboreum*, Swartz.) the British species of this genus amount only to five. (1.) The *P. vulgare*, or common polypody. This species, like others of the series, is capable of living, and even thriving without any other moisture than what it derives immediately from occasional showers, or from dew; for we find it generally on old walls, towards the north, with its finely divided fibrous brown roots, penetrating the old mortar, along with various mosses, which probably serve to retain the moisture thus occasionally derived from the atmosphere. The scaly tortuous stem is procumbent, and at intervals sends forth its pinnatifid pointed fronds, the lobes of which are serrated and blunt. These lobes produce the brown round groups of capsules in a single row, on each side of the middle fasciculus of the fronds, which alternating on each side of the stem, extend from a span to a foot in length. The most remarkable variety is that noted by Bolton, in which the pinnæ are formed into branches resembling the maternal frond. This variety is distinctly, but coursely, figured by Bolton, (tab. 2.) It is also figured by Morison, (sect. 14. tab. 2.) under the name of *P. Cambro-Britannicum, pinnulis laciniatis.* This is like some other ferns, well adapted to adorn rocks surrounded with shrubs. (2.) *Polypodium*? (an *Athyrium*?) *fontanum, fronde lineari lanceolata, acuta, pinnata, pinnis cordatis obtusiusculis pinnatifidis crenatis supra glabris*, (Sm. *Flor. Brit.* 3.) Smith thinks this species distinct from the *Aspidium fontanum* of Swartz. (3.) *P. phegopteris*, (Willd. *Sp. Pl.* 131.) The frond is pinnated, the pinnæ lanceolate, pinnatifid and united at the base, the under pinnæ bent back. This species is found in Lapland, and in the woods of most parts of Europe. (4.) *P. dryopteris*, (*Fl. Brit.* 5.) This species is the tender three-branched *Polypody* (*Eng. Bot.* 616.) (5.) *P. calcureum*, (Willd. *Sp. Pl.* 156. and *Fl. Brit.*) In this species the ternate bipinnate frond is erect, and more rigid; in other respects it resembles the last. It is the rigid three-branched polypody, and is figured by Bolton, as *P. dryopteris*, (53 tab.) Our British species then of this genus are very limited; but, indeed, we posses nearly the whole of the European species yet known.

In order, however, to give some idea of the very dissimilar habit of some foreign species of this extensive assemblage, it may be remarked, that the *P. lycopodoides*, (Willd. *Sp. Pl.* 12.) possesses entire lanceolate fronds, and an elongated creeping stem, covered with chaffy scales, from which it has its name; although it has but little resemblance to *Lycopodium*. Plumier, (*Amer.* tab. 42.) gives an expressive figure of it, under the denomination of *lingua cervina scandens.* It abounds in the woods of all the West Indian Islands. The *P. undulatum*, (Willd. *Sp. Plant.* 25.) possesses linear lanceolate, very entire fronds, above an inch broad, and extending to the length of twelve inches, undulated on the border, and narrowed both at the base and point; the ramified veins extending nearly in a longitudinal direction, parallel to each other. The *P. longifolium*, (Willd. 26.) has similar fronds, extending to the length of eighteen inches. Both these species are covered on the under side with white woolly down. The *P. tæniosum*, (27 Willd. *Sp.*) was discovered by Humboldt and Bonpland in South America, near Caripe. The fronds of this fern are also linear, little more than half an inch broad, and extending to the length of two feet, with the base very much attenuated. The *P. fasciale* of Willdenow, (Humboldt and Bonpland,) is figured by Plumier, (*Filic.* t. 127.) A nearer examination of these kindred species would, perhaps, warrant their being considered as congeners of a genus distinct from the *P. aureum*, and others deeply pinnatifid, such as the *P. dulce, P. decumanum*, and other kindred species. As to the *P. hyperboreum*, (128,) and *P. ilvense*, (129,) it is evident both must be excluded from this genus, if we attend to the valuable memoir of Brown, published in the eleventh volume of the Linnean Transactions, (p. 170.) in which he has demonstrated the true nature of these singular ferns. To the species described in the present edition of the *Sp. Plant.* (1810,) six others hitherto unknown are added by Brown, (*Prod. Flor. Nov. Holl.* 145, 146.) (1.) *P. confluens*, with linear entire lanceolate fronds, ash-coloured beneath, with the groups sometimes confluent, and a scaly creeping stem. (2.) *P. attenuatum*, likewise with linear lanceolate fronds, attenuated at the base, and a creeping stem. (3.) *P. membranifolium*, with a pinnatifid and reticulated frond, and minute scattered groups of capsules. (4.) *P. diversifolium*, the sterile fronds sessile, ovate, and sinuated; the fertile ones pinnated with lanceolate, ensiform, crenate, and subpetiolated fronds. (5.) The *P. rupestre*, apparently possessing affinity with *P. stellatum* of Swartz.

V. ASPIDIACEÆ. (Plate CCLIV. Fig. 15.)

This tribe was originally included in the genus *Polypodium* of Linnæus, but since the more accurate examination of the genera begun by Sir James Edward Smith, and continued by Swartz and Bernhardi, the polypodium has been divided into several more natural and distinct genera, whose groups of capsules, although separate, and in round spots, are covered with an involucrum, which in some of them is umbilicated and reniform, fixed at the centre, opening all around; and, in others, attached by one, and opening on the opposite side of the involucrum. Without, therefore, implicitly following Roth, there seems to be a certain degree of propriety in adopting his principle of separating these genera, although he erred in confounding them with the *Cyathea* of Smith, which belongs to a very distinct tribe. But since the publication of Sprengel's work, a genus totally distinct has been discovered by Humboldt and Bonpland in Mexico.

Genera.

(1.) *Pleopeltis*. (Willd. 1961. Humboldt and Bonpland.)

Capsules in round scattered groups, with numerous peltate involucra to each of them.

P. angusta. The stipes of this small fern is smooth, and about an inch in length: the frond, which is deeply pinnatifid, wedge-shaped at the base, and decurrent, is two or three inches long, covered thinly with brown scales. The groups are about the size of mustard seed, and to each of them there are about twenty of the brown peltate involucra. These distinct involucra separate this genus from the two following, but their form rank it with this tribe in affinity.

(2.) *Aspidium*. (Sprengel, *Anleit*. Gen. *Aspidii*, Willd. *Sp. Pl.* 1962).

Capsules in scattered round groups, invested with a round or reniform involucrum fixed in the centre, and opening all around.

Swartz and Willdenow (*Sp. Pl.* 5,) have united this genus with *Athyrium*, (*Polystichum*, Roth and Lamarck); but to us, the reasoning of Sprengel for keeping them separate, seems unanswerable. For, if the form and opening of the involucra be, as it is at present, the only characteristic principle of the generic character, we ought, in consistency, to adhere to it, until a better founded be discovered. The *Aspidium*, then, includes such genera as have their involucrum fixed in the middle, and emit their capsules all around.

Among the British species, are, 1. The *A. filix mas*, which affords a decided example of this genus, so as, even without the help of glasses, the kidney-shaped shields may be easily perceived opening around the edges, and discharging the brown capsules. This species, (whose elegant bipinnate fronds, from upwards of twenty inches to two feet long when in a proper soil, ought to become more frequently an ornament of the shrubbery,) possesses pinnules rounded at the extremity, finely serrated, and bearing in the end of summer the groups of capsules, in two rows, on the under side near the middle rib; the stipes densely beset with chaffy scales, and the stem, evidently short and near the surface, is hid by the remains of the decayed stipites, and generally confounded, even by botanists, with the roots, from which, however, it is totally distinct; for the roots are fibrous, shooting at intervals from the stem. It is singular that this species should be so generally diffused. It is a native not only of every part of Europe, but of the woods of Asia and the North of Africa; and, what is singular, Willdenow relates that he possesses a specimen of a variety from the island of St Thomas in the West Indies. This variety is in length the same as the common European species, but the pinnulæ are serrated only towards the end; and, in every respect, it closely resembles a variety found in Germany. There is another small variety found in poor mountainous situations.

Plate CCLIV. Fig. 7.

2. *A. fragrans*, with bipinnate fronds, primary lobes, ovato-lanceolate; secondary, narrow, toothed, their tender surface covered with the involucra, and scaly. This species emits the odour of raspberries. Is it *Aspidium oreopteris*? (Smith's *Flor. Brit.*). It was found by Hudson in England. This species also deserves a place in the shrubbery.

3. *A. aculeatum*, (Smith's *Flor. Brit.*), with a bipinnate frond, and pinnules ovate-lanceolate, with soft spines underneath, and chaffy stipites. (Bolton, *Pl.* 26. Prickly shield-fern).

4. *A. dilatatum*, (Willd. *Sp. Pl.* 100; Smith's *Flor. Brit.*; Schkuhr, *Crypt.* tab. 4.; Bolt. 23.). The frond is bipinnate, pinnules elliptico-lanceolate, with soft spines beneath, and much resembling the last; but the fronds are more rigid and shining. Pinnæ very close, and the pinnules more elliptical, and less cut. It is figured in *Eng. Bot.* 1460.

5. *A. lonchitis*. Fronds pinnate, with lanceolated, ciliated, and serrated pinnæ, and scaly stipites. The fronds are about a span long, erect, lanceolate, and narrow. Pinnæ nearly sessile, alternate, declining, acute, and spinulous: at the margin groups of capsules, frequently confluent.

6. *A. oreopteris*. The frond is pinnate, with the pinnæ pinnatifid, very entire, and the groups of capsules confluent on the margin. This species is figured by Bolton under the name of *P. thelypteris*, tab. 22, but far better in *Eng. Bot.* 1019. To these, Brown has added four new ferns, under the designation of *Nephrodium*, (Mich. *Flor. bor. Amer.*) 1. *N. obliteratum*. 2. *N. unitum*. 3. *N. decompositum*. 4. *N. tenue*. The *Nephrodium* seems to possess entirely the character of *Aspidium*. (*Prodr. Nov. Holl.*)

(3.) *Athyrium*. (*Aspidii* species, Willd. and Smith's *Flor. Brit.*)

Capsules in small round groups dispersed on the whole of the lower surface of the frond, covered with an involucrum attached by one, commonly the inner side, and generally opening towards the margin.

1. The *Athyrium* (*Aspidium*, Willd. *Sp. Pl.*) *thelypteris*, whose fruit is figured in Plate CCLIV. Fig. 11. affords a clear idea of the generic character as distinct from *Aspidium*. *A. thelypteris* has fronds nearly bipinnate, the pinnæ somewhat crenate and pinnatifid, distinct at the base, and decussated. The groups are confluent. The frond is erect, a foot high, lanceolate, and of a bright

green colour; the stipes is smooth and elongate; the pinnæ are opposite, but distinct and sessile at the base, lanceolate and pinnatifid, generally smooth; the lobes somewhat crenate at the point.

2. *A. filix fœmina*, with a bipinnate frond; the pinnules serrated, pinnatifid, with a smooth stipes and reniform involucrum.

The fronds of this species are eighteen inches long, broadly lanceolate, of a deep green colour, smooth as well as the stipites; the pinnæ are lanceolate and pinnulated, and these pinnules again pinnatifid. The groups of capsules are disposed as in *Aspidium filix mas*, but oblong and much less. It thrives best in moist and shaded places. The *Polypodium incisum* of Hoffman, is a variety of this species. Roth's *Athyrium ovatum* is another variety; and Muller's figure (*Flor. Frid.* t. 2. f. 3.) is an excellent resemblance of it, to which Roth refers for his *A. ovatum*. The *A. trifidum* of Roth and Hoffman, with very broad fronds, and the stipites beset with chaffy scales, is in fact another variety. This species is figured by Morison, (sect. 14. t. 3. f. 8; and Pluk. *Phyl.* t. 180. f. 4.)

3. *Ath. montanum*, (*Aspidium*, Willd. 147.) With more than twice compound ternate and tripinnate fronds; lobes remote, and the last ones very narrow; blunt at the tip, and acutely serrated. Plukenet found it in Wales. (*Phyt.* t. 89, f. 4.; Allione, *Fl. Pedmon.* 2410.)

Allantodia, (intermediate.) (Brown, *Prodr. Nov. Holl.* 149.)

Groups of capsules oblong, oblique, with respect to the rib; involucrum arched, originating laterally from a vein to which it is attached by both margins, and opening on the inner side.

This genus seems to be intermediate between *Athyrium* and *Asplenium*, and certainly distinct from both, although more allied to *Aspidiaceæ*.

Allantodia, Brown observes, is, in habit, intermediate between *Nephrodium*, (*Aspidium*, Sprengel), and *Diplazium*. There are two species discovered by Brown. The *A. australis*, with bipinnate, deltoid, flaccid, membranous fronds, and pinnatifid pinnules; attenuated towards the point, and oblong, blunt, serrated lobes, bearing numerous capsules under the oblong involucra. The *A. tenera* resembles the last, only the lobes bear their linear groups of capsules at the base only.

VI. ASPLENIACEÆ. (PLATE CCLIV. Fig. 16.)

The *Asplenium trichomanes*, a figure of part of the frond of which is represented in the Plate, may be assumed as affording the type of this tribe. It includes the *Cænopteris* of Bergius (*Darea*, Juss. and Willd. *Sp.*) which Brown observes differs only in having the pinnules deeply cut, narrow lobes, and hence the involucra close on the margin, and opening outwardly with respect to *the lobe*, but inwardly with respect to the rib, from which the fructiferous vein originates. There are also some species, whose fronds, partly answering to the character of *Asplenium*, and partly to *Cænopteris*, and even in the same involucrum, exhibiting thus the character of both. Of their affinity, then, there can be no doubt. In all the *Asplenia*, adds Brown, I have observed the involucrum originate from the superior branch of the vein, and always opening (*liberum*) towards the rib: this, he observes, is the most natural structure. Provided, however, it is situated on an inferior branch, which occasionally happens in certain species, whose fronds are undivided, the involucrum opens in a contrary direction.

GENERA.

(1.) *Darea*. (Jussieu, *Gen.* 15. Sprengel, *Anleit.* P. 3. fig. 24. Willden. 1966.)

Capsules in linear submarginal groups. Involucrum originating from lateral veins, and opening towards the rib.

There are none of the species of *Darea* hitherto found in Europe; most of them being native either of the Cape of Good Hope, Bourbon Island, or New Holland. This genus was first established by Bergius under the name of *Cænopteris*. The lines of capsules are generally situated in the marginal sinuses of the narrow lobes of the frond. The generic character is represented by Sprengel, in his third Plate, exhibiting part of the frond of *D. odontites*. Sometimes, however, the groups are at a greater distance from the margin. The *D. fumaroides*, lately discovered in Caraccas by Humboldt and Bonpland, to whom all the physical sciences owe so much, is a most beautiful species. The stipes is smooth, channelled, and half a foot long; the frond from three to five inches; bipinnate, the pinnæ and pinnulæ alternate; the pinnulæ are linear, obtuse, and bipartite, with bipartite laciniæ.

The *D. rhizophylla* is figured by Sir J. Edward Smith. *Cænopteris rhizophylla* (*icon.* in edit. tab. 50.) is a native of the West Indies. The *D. vivipara*, which is figured by Bergius, (*Act. Petrop.* 6. tab. 713.) affords an instance of buds being produced from the pinnulæ of the frond. This fern is found in the woods of Mauritius and Bourbon Islands.

(2.) *Asplenium* (Willd. *Sp. Pl.* 1967.)

Capsules in linear separate groups, originating laterally from a vein, and opening towards the rib.

Willdenow describes about one hundred of this genus, of which only eight are natives of Britain.

1. *A. trichomanes*. The stem of this elegant species is very short, enveloped with the decayed stipites of former years, and having in the centre of these the buds of the future season. The pinnæ of the frond are oval, finely crenate, with a stipes of a shining purple hue, carinated in the under side. It is generally found on the northern walls of our ancient buildings, where, although it requires but little moisture, it is in some measure protected from the total want of it. It is correctly figured by Sowerby in *Eng. Bot.* 576, and by Woodville, *Med. Bot.* tab. 204. A syrup was formerly prepared from a decoction of it, the whole plant possessing a slight astringency; but other ferns far exceed it in the proportion of sweet mucilaginous matter, abounding not in the frond, as Woodville observes, (*Medical Botany, ut supra*), but in their stems. Mr Teasdale found a variety of this fern with the frond branching.

2. The *A. viride* resembles the last, but differs, having a green quadrangular stipes; the pinnæ of the frond alternate, and of a paler green; the middle fasciculus of the frond is occasionally bifid.

3. *A. marinum*. This species has also alternate pinnæ, ovate, blunt as in *A. trichomanes*, and of a deep green colour, wedge-shaped at the base, and above sometimes united. On several parts of our coast, and in the sandstone caves at Wemyss in Fifeshire, observed by Sir Robert Sibbald. These three beautiful species possess an evident affinity with each other.

4. *A. alternifolium*, with a pinnated frond, and alternate, erect, wedge-shaped pinnæ, eroded at the point.

In this species the lines of fruit are less numerous, shorter, and paler than in the first described species. It is figured by Jacquin. (*Misc.* t. 5. f. 2.)

5. *A. lanceolatum*. In this species the frond is bipinnate and pointed; the pinnules obovate, dentate, and acuminated. It is a native of the south of Britain, and found by Mr Forster on the rocks at Tunbridge. It is about a span in length, the lines of capsules short, and few in number.

6. *A. adiantum nigrum*. With deltoid fronds, alternately tripinnate, and with lanceolate, cut, and serrated pinnules; figured by Bolton, 30. t. 17. There is a variety with fronds longer in proportion to their size. It is found on old walls, and at the roots of old trunks of trees. The smaller variety was found in a dark cave in the mountains of Mourne in Ireland; and in this variety the fronds are barren and membranous, elegantly laciniated.

7. *A. septentrionale*, with a trifido-pinnate frond, and linear alternate pinnæ, as it were torn at the point. It is found in the fissures of the greenstone, and other rocks in the neighbourhood of Edinburgh, where Willisel found it in Ray's time.

8. *A. ruta muraria*, with the frond alternately decomposed, pinnæ rhomboidal open eroded at the point, elegantly figured in *Eng. Bot.* t. 150. We have succeeded in obtaining germinating seeds of this, and other ferns, and found the experiment answer best in decayed mortar mixed with vegetable mould, taken from under the parent plant in ancient ruins.

Among numerous foreign species, the *A. fragrans* (Wild. *Sp.* 594. *Hort. Kew.* 15.) merits attention. This species has bipinnate fronds, and oblong acute pinnules, serrated at the point; but it is chiefly remarkable on account of its agreeable odour, resembling that of *Anthoxanthum odoratum*.

The *A. rhizophyllum* (Willd, *Sp. Pl.*) possesses, like certain other ferns, the property of emitting roots from the fronds, which are lanceolate, subcrenate, and auriculated at the base, and the buds germinate from their very long linear filiform points. This species, though perfectly hardy, is in few collections. It was introduced into Britain above a century ago by Mr John Bannister.

The *A. monanthemum*, a native of the Cape of Good Hope, is another singular species, having a solitary group of capsules on each pinnule. It was introduced in 1790, by Messrs Lee and Kennedy of London. To the species already described by Labillardiere, as native of New Holland, Brown (*Prodr.* p. 150.) has added the following new species unknown to Willdenow, viz.

(1.) *A. attenuatum*, with linear fronds, pinnated at the base, and entire above, and, like the last, radicant at the attenuated point. (Port Jackson.)

(2.) *A. paleaceum*, with ovate, rhomboid, dentate, striated and pinnate fronds, with a chaffy stipes, the point of the fronds also radicant; a circumstance common to several New Holland species, and which shews the absurdity of naming species from properties supposed peculiar to one.

Genera (insulated) of uncertain affinity.

(1.) *Scolopendrium*. (Sm. *Act. Taur.* t. 9. f. 2. 1968. Willd. *Sp. Pl.*)

Capsules in oblique linear groups, parallel to each other, between the secondary veins of the frond. Involucrum double, opening by a longitudinal fissure.

It is to the genius and accuracy of Sir J. Edward Smith, that we owe the separation of this and other genera of ferns from those originally established by Linnæus. Although before the reformation of the genera begun by him, this was without any accurate examination ranked among the *Asplenia*, with which, however, it seems to possess very little affinity.

1. *Scolopendrium officinale*, is a native of Britain, the stem is black, as in several other ferns, and scaly and short. The fronds, from ten inches to a foot long, according to circumstances, tongue-shaped, entire, and cordate at the base, and narrowed at the point; of a peculiarly firm texture, probably from the numerous transverse ramifications of the rib, or central fasciculi; smooth, and of a bright green colour. The stipites are of a dark brown colour, and very often scaly. The variations on the waved margin of the frond, or the occasional lobes produced at the point, are the effect of situation. Although, like the rest of the series, it will grow on the most elevated ruins, in the crevices of the stones, it attains a large size on a richer damp mould.

2. *Sc. hemionitis*, bears great resemblance to the last; the base of the frond, however, instead of being cordate, is hastate, that is to say the lobes are angular rather than rounded below, like those of the first species. This fern is figured by Cavanilles, *Annal. de Sciences Natur.* tab. 41. and Morison, sect. 14. t. 21. f. 2.

(2.) *Diplazium*, (Swartz, *Syn. Filic.* p. 4.; Willd. *Sp. Pl.* 1069.; Callipterid. *Sp. B. de St Vincent.*)

Capsules in distant double lines, simple, or branched. The involucra double, each opening towards the margin of the frond.

Willdenow describes ten species of this genus, which, although in habit somewhat resembling certain *Asplenia*, is too distinct from them to be considered of the same tribe. Like *Scolopendrium*, it possesses a double involucrum, opening in a manner the reverse of that genus. It remains, therefore, for future observation, to enlighten us as to the real place these, and no doubt other genera, really occupy in a natural series. In the mean time, we are much indebted to Swartz, Bory de St Vincent, and Willdenow, for all as yet known of the species. The *D. plantagineum* is figured both by Swartz and Schkuhr, (Swartz, *Syn.* 91. tab. 2. and Schk. *Crypt.* tab. 86.)

The *D. æsculentum* is a native of the East Indies, and Willdenow in his definition of this species has corrected an error of Swartz, in describing it as bipinnate, Swartz having only a pinna, which he mistook for the entire frond. This species derives its name from the stem abounding more with that sweet gummy sap, which is common, as already observed, to the greater part of the series, even in Europe.

The *D. arborescens*, (*Calipteris*, Bory. *Itin.*) is an elegant species, inhabiting the woods of Isle de Bourbon. The fronds resemble the most magnificent of those of palms, extending from four to six feet, or more, in length; and even the alternate pinnæ are from eighteen inches to two feet long; the pinnulæ three inches, the superior ones gradually lessening. The groups are linear, and decussated. It differs from the last in having an arborescent stem, and in the division of the fronds, although it is evidently nearly allied to it.

(3.) *Vittaria*. (Sm. *Act. Taur.* Willd. 1971.)

Capsules in continuous marginal or dorsal lines; the involucrum double, and of the texture of the frond; the one opening outwardly, and the other inwards.

Of the eight species described by Willdenow, the greater part have linear membranous, pendulous or filiform fronds.

In the *V. filiformis*, which is a native of Peru, the fronds are two or three feet long, and only half a line broad; and in the *V. zosteræ-folia*, the stem is of the thickness of a goose quill, covered with chaffy scales, and the frond, extending to the length of five feet, is pendulous, and only three or four lines in breadth; and never, perhaps, was a species seemingly better named, if similarity is regarded, for it has quité the appearance of *zostera marina*.

The *V. ensiformis* and *V. plantaginea* have erect fronds; and the *lanceolata*, it has been already observed, seems to belong, with *Hemionitis reticulata*, to a distinct genus. This fern is figured by Schkuhr, (*Crypt.* tab. 101.) According to Brown, the *V. elongata* is a native of New Holland, though also of the West Indies, according to Swartz.

VII. BLECHNIDEÆ. (Plate CCLIV. Fig. 17.)

The genera of this tribe resemble each other in habit, and in the arrangement of the groups of capsules. In *Blechnum*, the lines of these groups are continuous; whilst in *Woodwardia* they are interrupted; but in both genera they are parallel on each side of the rib of the frond, and in both the involucrum opens inwards or towards the rib; indeed, both genera were confounded until separated by Sir J. Edward Smith. The affinity of *Doodia* and *Stegania* is equally manifest with the former.

Genera.

(1.) *Woodwardia.* (Sm. *Act. Taur.* 5. tab. 9. fig. 5. Willd. 1978.)

Capsules in short interrupted, or oblong lines, on each side of the middle rib. Involucrum arched, opening inwards.

An accurate idea of the generic character, is afforded by Sprengel in his fourth plate, fig. 29, (vid. *Introd. to Crypt. Plants*,) representing *Woodwardia japonica*, (his *Bl. Japonicum*.) Of the seven species enumerated by Willdenow, only one, *W. radicans*, is a native of the south of Europe. Of this, there is a figure by Schkuhr, (tab. 112,) and of a variety, (tab. 118.) The rest are all natives of warm climates. Brown (*Prodr. Nov. Holl.* p. 151) has arranged *W. caudata* of Willdenow, with two additional species from New Holland, in a distinct genus, under the name of

(2.) *Doodia.* (Brown, *Prodr. Nov. Hol.* p. 151.)

Capsules in lunulated or linear groups, in rows parallel to the rib. Involucrum originating from an anastomosing branch of a vein, plane, and opening inwards.

This genus is nearest to *Woodwardia*, and, as Brown observes, has an equal affinity with it, as *Asplenium* has with *Allantodia*.

The designation *Doodia* he conferred on this genus, in memory of Samuel Doody, an apothecary of London, who was among the first botanists who investigated cryptogamous plants.

(3.) *Blechnum.* (Lin. Smith, Swartz, and Willd. *Sp.* 1972.)

Groups linear, longitudinal, continuous, parallel to each other on both sides of the middle rib of the frond. Involucra opening inwards.

The *Blechnum* is at once distinguished by the continuous lines of the capsules, parallel with, and close to the rib on each side. Of the twenty species described by Willdenow, the greater part are natives of the tropics. The *Blechnum occidentale* is common in every collection, as it thrives better in the stove than many other foreign genera. It has been for several years kept among those of the botanic garden at Edinburgh. The *Blechnum boreale* is the only species hitherto known to be a native of Europe, and, what is singular, it is also found in the Canary islands, but of course only in alpine situations. The linear narrow fertile pinnæ, no doubt contracted and exhausted by nourishing the fruit, caused it formerly to be confounded with *Osmunda*, under the ridiculous term *Spicant*.

(4.) *Stegania.* (Br. *Prodr. Nov. Holl.* p. 152.)

Groups linear, continuous, the capsules at length covering the back of the contracted frond, or of the pinnæ. The involucrum scarious, opening inwards.

None can peruse the brief notes of the author of the *Prodr. Nov. Holl.* without being reminded of the learning and judgment of the author. These notes, like those of Jussieu, (*Gen. Pl.*) generally in a few words convey a degree of information that could only be obtained by a patient and diligent enquiry into nature. The *Stegania*, he observes, possesses nearly the habit of *Blechnum*, to which it is next in affinity; although in character it approaches to certain *Pterides*, at least some that are at present reckoned to belong to *Pteris*. The *Blechnum procerum*, indeed, of Swartz and Labillardiere, with the *Onoclea nuda* of the last named author, ought to be ranked as *Steganiæ*. To these, however, he adds six hitherto unknown species; the *St. patersoni, lanceolata, fluviatilis, alpina, falcata*, and *minor*. Of these, *St. patersoni* has undivided fronds, the sterile ensiform and crenate; and the fertile fronds linear; the remaining species being all pinnatifid, or pinnated. The *St. nuda* (*Onoclea*, Lab.) is figured by Labillardiere, (*Nov. Holl.* p. 96, tab. 246,) and the *St. procera*, (*Blechnum*, Lab. p. 96, tab. 247.) But, alas! when Brown will be enabled to publish his fine drawings of these and numerous other rare plants, it is impossible to foretel. After these species, if striking affinity is to be regarded, *Stegania onocleoides*, (*Pteris crispa*, Willd. *Sp.* 395.) must be added as intermediate between *Stegania* and *Onoclea*.

VIII. ONOCLEACEÆ. (Plate CCLIV. Fig. 18.)

Willdenow having, in the last edition of the *Species Plantarum*, arranged the former *Onoclea* under three separate genera, all of which possess a close affinity, there can be hardly a doubt as to the propriety of arranging them as a natural tribe. Willdenow's genus *Onoclea* now contains only one species, the *O. sensibilis*; but on the authority of Brown, (*Prodr.* 152.) *O. struthiopteris* is added to this genus, and consequently the *O. pensylvanica*, (*S. pensylvanica* of Willd.) In all of them the involucrum is formed by the reflex margin of the frond.

Genera

(1.) *Onoclea.*

Capsules densely covering the under part of the frond. Involucrum consisting of the reflex margin of the frond, and opening inwards.

The definition of this genus by Swartz is to be preferred to that of Willdenow, until it is ascertained whether the "*indusia non dehiscentia*" be really analogous with the involucra heretofore supposed to be characteristic of *Onoclea*, as figured in our Plate, and expressed in the generic definition.

1. *O. sensibilis.* This singular species is a native of America, and was introduced into this country in the year 1699, by Bobart. It endures the climate of Britain in the south. The sterile fronds are pinnate,

the pinnæ as it were cut, but united towards the extremity of the frond; the fruitful fronds are bipinnate, the pinnulæ being folded back in a globular form. This fern possesses the singular property of withering soon after being touched by the hand. Sprengel thinks, that the perspirable matter exerts this deleterious influence on the plant, as he repeatedly touched it with other bodies without injury. A figure of it is given by Morison, vol. iii. sect. 14. tab. ii. fig. 10.

2. *O. struthiopteris*, (*Struthiopteris Germanica*, Willd. *Sp.*) This species is one of the rarer European ferns. It occurs in the shady forests of Germany and the Tyrole on mountainous situations, and also in Sweden and other northern parts of Europe. It is figured in *Flor. Dan.* tab. 169; but this figure is not very well executed.

3. *O. pensylvanica*, (*Struthiop. Pensylv.* Willd. *Sp.* 5. 289,) is another species very like the last, but different in having the laciniæ rounded and blunt, and the undermost acute, and longer. *O. nodulosa* of Swartz is, according to Brown, (*Prodr.* ut supra,) a *Woodwardia*, (*Woodw. onocleoides*, Willd. *Sp.* 1073.)

(2.) *Lomaria*, (intermediate,) (Willd. *Sp. Pl.* 1963. *Onocleæ*, Sp. Bory. and Swartz.)

Capsules densely covering the inferior part of the frond. Involucrum continuous, marginal on each side of the frond, and opening inwards.

Of this genus, Willdenow describes eleven species, all of which are taken from the *Onoclea* of Swartz, (*Synops. Fil.*) and Labill. (*Nov. Holl.*) and Bory. (*Itin.*) In affinity, they approach so near to *Onoclea*, that it is difficult to give them a determinate and distinct character, as must be the case in all natural genera, when the intermediate links of the series are discovered. The involucrum is continuous on each side of the frond, and approaching nearer to that of *Pteris* than of *Onoclea* itself. The most magnificent of the species is the *O. Boryana*, so named as a just tribute to this celebrated botanist. It is figured by Bory. (*Itin.* p. 194. tab. 3.) himself. He found it in the barren mountainous parts of the island of Bourbon, and he gave it the name of *Pteris osmundoides*. The sterile fronds are pinnate; the pinnæ sessile, oblong, bluntly lanceolate, and very entire. The fruitful fronds are also pinnate, and the pinnæ are linear, and entire. The stem is erect, and four feet high. The sterile fronds are two or three feet long; the fruitful ones shorter, and their pinnæ very narrow. This fine species, like most of the other arborescent ferns, is unknown in our collections. Willdenow is in doubt whether the *L. scandens* be not an *Acrostichum*, to which, in some measure, the *Lomaria* approaches in appearance. The *Lomaria variabilis* was also reckoned an *Osmunda* by Bory. (*O. trifrons*,) as well as the *L. fraxinea*, (Willd.) from his not observing the ring of the capsules.

IX. PTERIDEÆ. (Plate CCLIV. Fig. 19.)

The genus *Pteris*, here assumed as the type of this tribe, is at present by far the most extensive of the whole series. Willdenow having, in the (*Sp. Plant.* 5.) described a hundred and eight species; and although Dryander had previously, from a more accurate examination of the structure of the involucra of certain species, with great judgment separated from it the *Lindsæa*, there is scarcely a doubt but future observers will be enabled still farther to analyse, and more distinctly arrange, the kindred species of this numerous assemblage. Brown, whom we have had occasion so frequently to quote, has already observed, "*Pteris thalictroides distinctissimum genus constituit.*" *Pteris crispa* is, in fact, of a distinct genus, and has been already placed by us as a species intermediate between *Stegania* and *Onoclea*, until future observers be enabled to detect its unknown associates. *Pteris auriculata* of Thunberg, in which the arched involucrum includes the groups of capsules in an inflexed margin, must in like manner be distinguished as a genus; already therefore the present Pterides may be presumed to be a great natural tribe, including several distinct though kindred genera.

(1.) *Lindsæa* (Dryander, *Act. Soc. Lin.* 3. p. 40. et Sm. *Act. Taur.* tab. 5.)

Capsules in continuous lines, and frequently very near the margin of the frond. Involucrum scarious, originating from the under membrane of the frond, and opening outwards.

It is to the late venerable Dryander, that we owe the distinction of this genus from *Pteris*; for both Aublet and Swartz had associated the respective species with *Adiantum*; although they ought, he observes, in consistency with the Linnæan character, to have been referred to *Pteris*, with which indeed they have an evident affinity. *Lindsæa* received its name in honour of Lindsay, an ingenious botanist of Jamaica. Dryander (*Trans. Lin. Soc.*) describes nine species of great beauty, and diversity of form.

The *L. reniformis*, a singular species, (*Lin. Tr.* fig. 1. *ut supra*,) has an entire reniform frond, without the smallest indentation, the stipes being attached to the sinus, formed by the two lobes of the frond. It is to be regretted, that in the eight species described by Dryander, we have no account of the stem, as the examination of the frond alone is insufficient to ascertain completely their habit. The *L. tenera*, likewise figured by Dryander, posseses great beauty. The frond is tripinnatifid, and the laciniæ elegantly cut into obovate or rhomboidal forms.

In no genus are the ramifications of the vascular fasciculi from the stipes more beautifully displayed than in this.

To the eight described by Dryander, Willdenow has added twelve more from Bory. Labillardiere, Swarts, Humboldt and Bonpland; and to these Brown (*Prodr.* p. 156.) has added *L. media* with deltoid bipinnate fronds, and coriaceous, obovate, rhomboidal pinnules, lobed in the under part, and elsewhere entire. The sterile fronds are serrated at the point, and have a quadrangular stipes. This species, like most of the others, inhabits the tropics.

(2.) *Pteris.*

Capsules in continuous marginal lines; and marginal scarious involucra, originating from the inflexed upper membrane of the frond, and opening inwards.

The species, *Pt. lanceolata*, and *Pt. piloselloides*, according to Brown, belong to *Tænitis*, and, with *Blechnum seminudum*, *Onoclea spicata* (Sw.), ought to be transferred to that genus.

The following species are natives of Europe.

1. *Pt. ensifolia.* This species has pinnate fronds, with very long sessile, lanceolate, tapering pinnæ, and a creeping stem. It is found in Spain and Algiers, and figured under the name of *Polypodium majus*, (Barr. *Ic.* iv.)

2. *Pt. cretica*, with pinnate fronds, and the pinnæ with short footstalks, lanceolate and acuminate, narrow and serrated at the base; the undermost bipartite or ternate; figured by Schkuhr, *Crypt.* 85, tab. 50.

3. *Pt. palustris*, with pinnate fronds; petiolated, oblong, lanceolate, and pinnatifid pinnæ; laciniæ

lanceolate, subcrenate at the point. Native of Portugal, and figured by Tournefort, (*Inst.* tab. 313.)

4. *Pt. crispa* (*Steganía onocleoides nobis*), *Osm. crispa*, Lightfoot, (Bolton, *Fil.* tab. 7. *Pt. crispa*, Smith's *Fl. Br.* 3. 1137. *Eng. Bot.* tab. 1160.)

5. *Pt. aquilina*, with a tripartite frond; the branches bipinnate; pinnæ linear lanceolate; the uppermost undivided, and the undermost pinnatifid, with oblong obtuse laciniæ; figured by Bolton, (16, tab. 10; Schkuhr, tab. 96, *Crypt.*) It is singular, that this species should be so much dispersed. It is found in the barren woods and downs of Europe, Asia, and North America. The variety figured by Schkuhr, (tab. 96,) originates from disease, the frond being infested by fungi, (*Sphæria*). This fern affords an instance of the subterraneous stem common to many ferns and various other plants, particularly the *Gramineæ*. On cutting across the stem, the vascular fasciculi have been imagined, by the superstitious, to resemble a cross; others have compared this appearance to a spread eagle; and the name has been derived from this circumstance, according to some. But probably the remarkable appearance of the pinnæ of the frond, extending occasionally to nearly five feet in length, has given rise to the name.

There are certain foreign species of *Pteris* with erect arborescent stems, particularly the

(1.) *Pt. aculeata* (Willd. *Sp. Pl.* 5.) with bipinnate fronds, and oblong acuminate pinnatifid pinnulæ, with lanceolate pointed and serrated margins. The magnificent stem, and the stipites, are both thorny. It is figured by Plumier, (*Plantes de l'Amerique*, tab. 3.) and is a native of the West India islands, particularly St Domingo (Hayti) and Jamaica.

(2.) *Pt. esculenta*, with a tripinnate frond and bipinnate branches, linear, obtuse, crenulate, rigid, decurrent pinnulæ, the undermost subpinnatifid. This species is found in the woods of the Society Islands and of New Holland. The best figure is that of Schkuhr, (*Crypt.* tab. 97.) The term *esculenta* is far from being appropriate, as many of these plants abound with similar sweet mucilaginous matter in the cellular substance of the stem. See also Br. *Prodr. Nov. Holl.* p. 154. Brown has also described three new *Pterides*, approaching in habit to *Adiantum*, viz. *Pteris falcata*, *Pt. nitida*, and *Pt. nudiuscula*. Vid. *Prod.* ut supra.

(3.) *Adiantum*.

Capsules in punctiform or linear groups, and inserted into the involucra formed by the inflexed margin of the frond, and opening inwards.

This genus possesses so clearly an affinity with the one just described, that they, as it were, pass into each other by the *Pterides adiantoideæ*, just mentioned, of Brown. In this case, we have an instance of what is seldom met with, the natural series in a connected state, and not disjointed and scattered, as we generally find it; so that if the *Pteris* and *Adiantum* cannot be well defined, our view of the series is on that very account the more complete. In offering a general sketch of the genus, then, the species approaching nearest to *Pteris* ought to be noticed first; but the want of a closer examination of certain species than has hitherto been made, renders this a most difficult task.

Of upwards of fifty species described by Willdenow, only one has hitherto been found in different parts of Europe, and we possess it also in Britain, the *A. capillus veneris*. In this fern, the frond is alternately decompound, the pinnulæ, with footstalks, in wedge-shaped lobes; the involucra are kidney-shaped. It is figured by Bolton, tab. 29. This elegant species is, like some others, dispersed not only over Europe, but is found on Teneriffe, Jamaica, Isle de Bourbon, and South America. It varies much in size.

Of the foreign species there are three with simple kidney-shaped fronds, the *A. reniforme* and *A. Asarifolium* of Willdenow. The first is figured by Plukenet (*Alm.* tab. 287. fig. 5.) and the second by Lamarck, (*Illust. Gen.* tab. 80), and Schkuhr, (tab. 115). Both these resemble each other very much; the frond of the first is, however, crenate; and of the second, very entire, and broader than long. The third, *A. philippense*, is represented also to have a simple frond; but it is figured by Petiver laciniated, (*Gazoph.* tab. 4. fig. 4.)

Of the *Adianta* with pinnated fronds, the *Rhizophorum* affords another instance of the naked elongated point of the frond containing buds, producing new plants. Humboldt and Bonpland found several new species of *Adiantum* in South America, particularly the *A. varium*, which, although possessing, along with several other species, continued groups of capsules, Willdenow refers to this genus: Probably these may, after all, be *Pterides*. The *A. tetraphyllum*, *A. politum*, *A. serratodentatum*, and *A. concinnum*, were all found in South America by the indefatigable Humboldt and Bonpland. Besides those species described by Willdenow, the following have been since discovered by Brown.

1. *A. paradoxum*, with pinnate fronds; the pinnæ cordate, oblong, or lanceolate; the veins below obsolete, and the groups of capsules linear and continuous.

2. *A. formosum*, with fronds decompound, deltoid and leaflets tripinnate, with rhomboidal, smooth, and blunt pinnulæ, the lower ones cut; the involucra kidney-shaped, and the stipes itself rough, but its ramifications smooth.

(4.) *Cheilanthes*, 1976, Willd. Swartz, *Fil.* p. 5.

Capsules in punctiform or crescent-shaped groups, inserted into the sinus of the scarious involucrum, formed by a portion of the margin folded back, and opening inwards.

The whole of the species have been separated from *Adiantum*, with which they have the closest affinity; but the interrupted punctiform or crescent-shaped groups of the fruit, distinguish them; and, on a closer view, the capsules are seen inserted into the sinus of the involucrum. Of the thirteen species described by Willdenow, there are three remarkable for an agreeable odour:

1. *Ch. suaveolens*, *Polypodium sauveolens* of Desfontaines, with bipinnate smooth fronds, and very entire oblong ovate pinnulæ, the inferior pinnæ pinnatifid, filiform, and hairy stipes. This species is figured by Schkuhr, (*Cr.* 116, tab. 19.) It is a native of Barbary and Natolia.

2. *Ch. odora* has also bipinnate fronds, but the pinnulæ, instead of being perfectly entire, like those of the last, are pinnatifid, with rounded entire borders. The stipites resemble the last. This species is a native of Switzerland and Italy, and ought to be introduced into this country, the climate of which it would endure.

3. *Ch. fragrans* has also bipinnate fronds, with oblong, lanceolate, obtuse, pinnatifid pinnulæ, and somewhat bifid laciniæ; the stipites chaffy. The fragrance of these three species renders their culture an object of particular interest, yet the last is the only fragrant species as yet introduced into the collection at Kew by Mr F. Masson. The *Ch. fragrans* is figured by Swartz, (*Syn.*

Fil. tab. 3. fig. 6.) The *Ch. pteroides* is also in the Kew collection. It is figured by Houttuyn, (p. 120, tab. 96, fig. 3.)

Ch. lentigera, with tripinnate somewhat villous fronds, with minute orbicular folioli, is a singular species. (*Comment. Petrop.* x. p. 302, tab. 22, fig. 3.) The *Ch. arborescens* is the only species with an erect stem. This is the *Lonchitis tenuifolia* of Forster.

(5.) *Lonchitis*, (Willd. 1977; Schreber, *Gen. Plant.* 1629.)

Capsule in separate crescent-shaped groups, inserted into the sinuses of the frond. The involucrum formed by the margin of the frond bent back, and opening inwards.

This genus of Schreber seems to be more conveniently united with the last by a slight alteration of the definition; so that his four species of *Lonchitis*, added to *Cheilanthes*, will include, in all, twenty-four kindred species, to which Brown has added, from New Holland.

Ch. caudata, with bipinnate somewhat triangular smooth, pinnatifid pinnæ, and round, lateral lobes. In this species the groups of capsules become confluent, and the involucra obsolete. The figure of *Lonchitis hirsula* (Willd. *Sp.* 5.), given by Sprengel (*Anleit.* tab. 4. fig. 27.), affords a good idea of this genus.

Davallia (insulated), (1978, Willd. *Sp. Pl.* 5; Smith, *Act. Taur.* 5, p. 414, tab. 9, fig. 6.)

Capsules in punctiform marginal distinct groups; involucrum superficial, somewhat hooded, opening outwards.

Linnæus formerly united the various species of this genus with others, to which their external appearance and habit seemed to point. It is a distinct genus, however, as Dr Smith has shewn. The groups are situated on the veins or ramifications of the vascular fasciculi, at the margin of the frond. Sprengel has given an excellent figure of the generic character, (Plate IV. fig. 33.) in *D. adiantoides*, (Willd.) an arborescent species from St. Domingo, figured also by Plumier, (*Fil.* 8. tab. 7.)

Willdenow describes 34 species of *Davallia*, but there is certainly room for a closer examination of these, when it is observed, that Sprengel, whose accuracy is not to be impeached on slight grounds, gives, as an illustration of the genus *Adiantum*, a figure taken from a species asserted by Swartz and Willdenow to be a *Davallia* viz. *dumosa*. The *Davallia hirsuta* (Willd.) is *Trichomanes hirsutum* of Thunberg; and *Davallia tenuifolia* (Willd.) is *Adiantum tenuifolium* of Lamarck, (*Encycl.* 1. p. 43.) It may be further added, that *Davallia canariensis* is the species which we have selected as illustrative of the structure of the creeping stems of this series. This was the *Trichomanes canariensis* of the *Sp. Pl.* (1562) and *Brot. Lusitan.* p. 395. This species, which is in the Edinburgh collection, has tripartite fronds alternately decompound, with lanceolate sterile laciniæ, and obovate fruitful ones. It is figured by Plukenet (*Alm.* 156, tab. 291, fig. 2.) It is the only European species as yet known, and found in Portugal and the Canary Islands.

The *Da. arborescens of* Willdenow, the *Filix arborescens adiantoides* of Plumier, (*Fil.* t. 6.) is found in Hispaniola. It is certainly difficult to devise appropriate specific names for so many plants, which, like the ferns, resemble each other so strongly; but one would have thought the designation *arborescens* rather unappropriate, unless, which is impossible, we were certain that no other arborescent species of the genus existed. This fern has bipinnate fronds; oblong, lanceolate, acuminate, and pinnatifid pinnulæ; oblong and bluntly laciniated, and crenate on the superior margin.

The *Da. elegans*, figured by Schkuhr, (*Crypt.* 127.) under the name *bidentata*, is a native of Java, and has also bipinnate fronds, (the undermost pinnæ being themselve bipinnate,) with oblong lanceolate, and serrated pinnulæ, wedge-shaped at the base. This species might, from the present connection of Java with this country, have been easily introduced into our home collections.

X. CYATHEACEÆ. (Plate CCLIV. Fig. 20.)

Sir J. Edward Smith, to whom we have had occasion so frequently to refer, first distinguished, from the *Polypodium*, the genus which we have selected as the type of this singular tribe of ferns. In all the tribes of the series hitherto noticed, the involucrum is superficial, but in this it is formed under the groups of capsules, more or less in the shape of a cup, and in general the capsules are attached to a receptacle, elevated within this cup. The *Dicksonia*, which we have placed first in this link of the series, has not a distinct receptacle in all the species; but in some the traces of one are perceptible; and we should have erred in excluding it from its kindred genera, although in the *Cyathea* of Smith the character is, no doubt, strongest. But let it be recollected, that the principle of the natural arrangement is essentially different from that of an artificial system, in which all the genera are necessarily distinct, and their characters decided; whereas in the natural series, the groups approach each other by shades, frequently blended, and are abrupt only when the links of the series are either broken or undiscovered, or perhaps lost in the numerous changes the surface of the globe has evidently undergone.

(1.) *Dicksonia*. (Willd. 1979. L'Heritier, *Sort. An.* 930.)

Capsules in distinct pointlike, or round marginal groups. Involucrum cup-shaped, double, or as it were bivalve, the true one membranous, originating from a vein, opening outwards; the other spurious, from the reflex lobule of a pinna.

In this genus then, the cup containing the capsules is formed by the more or less perfect union of the involucra, and within the true involucrum, there is, in some species, a small knob serving the purpose of the columnar receptacle of the other genera of this tribe. Sprengel (*Anleit,* t. iv. fig. 81.) gives a correct idea of this genus in a figure of *Dicksonia flaccida*; the general character of *Polypodium*, adopted by Linnæus, including this and several others. Indeed, from the marginal situation of the groups of capsules, this genus externally resembles *Davallia*; but a careful examination soon points out the difference between them. A figure of *Dicksonia flaccida* (Willdenow and Swartz) is given also by Schkuhr, (T. 129). This fern is the *Trichomanes flaccidum* of Forster, (*Prodr.* 472). All the genera are foreign, and for the greater part tropical. Several of them have arborescent, or erect stems; although, in order to shew the absurdity of such a specific designation, one species only is termed *D. arborescens*. This species is native of St Helena. It has bipinnate fronds, with ovate, somewhat sharp, entire pinnulæ, with partly united lobes, (Sm. *Act. Taur.* iii. p. 496.) The *D. squarrosa*, (Swartz, *Syn.* 136.) and figured by Schkuhr, is another erect, or arborescent species, (*Trichomanes squarrosum*, Forst. *Prodr.* 476). The *D. adiantoides* (Humboldt and Bonpl.) *frondibus triplicato pinnatis*, &c. (Willd. 5. *Sp. Pl.*) has fronds seven or eight feet in length, the primary pinnæ two feet long; but Willdenow, as usual, omits to notice the length of the stem, which, in some species, bears no great proportion to the length of the fronds. Brown observed, at Port Jackson, a species, the *D. davalloides*, much akin to the *Davallia dubia*. *D. antartica*, is figured by Labillardière (*Nov. Holl.* 2. p. 100. tab. 249.)

(2.) *Alsophila*. (Brown. *Prodr. Nov. Holl.* p. 158.)

Capsules in globular, distinct dorsal groups, on the ramification of a vein; sessile and inserted into a common elevated receptacle, situated within the involucrum, which is sometimes multifid, and sometimes obsolete.

Of this genus, which was discovered by Brown in New Holland, there is only one species as yet known, viz. *Alsophila Australis*, with decompound smooth fronds, and bipinnate leafits, the pinnæ attenuated at the point; and the pinnules oblong, somewhat blunt, and serrate in the base; the involucrum nearly divided into two halves. The stem is erect or arborescent, and the fronds firm, and somewhat coriaceous.

(3.) *Woodsia*. (Brown, *Linn. Trans.* vol. xi. p. 170. Pl. 2.)

Capsules in round groups; involucrum membranous cup-shaped, open, the margin divided into filaments, and including the pedicillated capsules, without any elevated common receptacle.

This genus has an evident affinity with *Alsophila*, in which the margin of the cups is also multifid; although nothing like so finely divided as to have the appearance of hairs. This fine genus still further reduces the number of the *Polypodia*; and it is to be hoped, that the excellent observer who discovered it, will continue his invaluable inquiries, into that and others of the present genera, of this great series, following the injunction of our great master—TENTANDA *igitur pluries characterum estimatio, unde certior eruetur generum ordinatio, cum universalis tum partialis.* (Jussieu, *Gen. Plant. Præf.*)

Some years since Brown observed the cup-like involucrum in *Woodsia* (*Polypodium*, Willd. *Sp. Pl.* 5. and Sm. *Flor. Britannic.*) *hyperborea*, and he has since repeatedly ascertained it in *Woodsia ilvensis*. In fact, these two ferns are so very nearly alike, that it is difficult to distinguish them as species. Sir J. Edward Smith describes the *P. ilvense* (With.) and *hyperboreum* of Swartz as one species, under the name of *P. arvonicum*. The stem of this fern is very short, surrounded with the decayed stipites of former years; the fronds are from two to four or five inches long, obtusely lanceolate. The pinnæ are distant, lobed, bluntly triangular, and sometimes opposite, often alternate, the hairy margin of the involucrum extending over them. This is one of the least of our native ferns. It is found in alpine situations, on Snowdon, Benlawers, and others of our mountains.

(4.) *Cyathea*. (Sm. *Act. Taur.* v. 5. 416. *Polypodium*, *Gen. Pl.* 560. Juss. 15.)

Capsules in round distinct groups, attached to a hemispherical or club-shaped receptacle contained within he cup-shaped involucrum, which opens above.

In this genus the capsules are attached to a columnar, levated receptacle, by their pedicles.

Sir J. Edward Smith at first considered three of the rmer *Polypodia*, viz. the *P. fragile*, *P. regium*, and *P. dentatum* of the *Sp. Pl.* (1553.) as *Cyatheæ* (see *Flor. Brit.* p. 435.); but Swartz and Willdenow, (5, 273—80—81) have arranged these species with *Aspidium*; and in fact, none of the *Cyatheæ* have as yet been found in Europe. Nearly the whole of the sixteen species described by Willdenow have erect stems. The *C. speciosa*, found by Humboldt and Bonpland, near Caripe in South America, has, like most of the species, the aspect of a palm, being twenty-four feet in height; the fronds finely spreading, and extending five feet around the trunk, and the pinnæ petiolated, linear, an inch broad, a foot long, finely pointed, and wedge-shaped at their origin; sinuate, and dentate along their margins. The groups of fruit in this, as in several of the species, are placed sparsely along the margin of the pinnæ.

The *C. arborea* is by no means the most remarkable for the length of its stem, which is very hard, and covered with the scales, so frequently abounding in the whole series. This fern is the *P. arboreum* of *Sp. Pl.* (1554.) Rumphius (*Amb.* p. 62. t. 27.) describes other three much akin to this West Indian species. The *C. excelsa*, (*Arborea*, Bory.) is found in the Mauritius, with a stem twenty-five feet high. The *C. glauca*, is another magnificent fern, found by Bory. (*Itin.* 206.) in the mountains of the Isle de Bourbon. The fronds have not hitherto been brought to Europe; but we may, in some degree, calculate their extent and magnificence (*ex pede Herculem*) from that of their pinnæ, which are, according to Willdenow, eighteen inches long. In this species, the groups of capsules are situated, one on each side of the middle rib of the pinnulæ. The specific term *glaucus*, is derived from the colour of the under part of the pinnulæ, which, when viewed by the microscope, seems to be owing to the minute scales with which they are covered. Several species, as the *C. aspera* and *C. horrida*, have their stem and stipites covered with hard prickles. The *C. villosa*, lately found by Humboldt and Bonpland, is remarkable for having the groups of capsules invested with a woolly covering.

The *Cyathea medullaris* (*Polypodium* of Forster; *Sphæropteris*, Bernh.) is remarkable for the abundance of that saccharine gummy juice which is so common, in greater or less quantity, in the stems of the whole series, and is used as an article of diet by the inhabitants of New Zealand.

Brown has already demonstrated the necessity of separating the *C. multiflora*, Sm. *Horrida*, Sm. *Capensis*, Sm. and others as yet undescribed, from *Cyathea*, under the designation of *Hemitelia*, on account of their arched involucrum, with a semicircular base, inserted under the receptacle.

(5.) *Trichomanes*. (Willd. 1981.)

Capsules marginal, sessile, inserted into a cylindrical common receptacle, contained within a monophyllous pitcher-shaped open involucrum, of a similar texture with the frond.

Trichomanes brevisetum, (Br. *Prodr.*) *Hymenophyllum alatum*, (*Eng. Bot.* 1417. p. 159.) is the only species native of Britain. As there is already a *Trichomanes alatum* native of the southern mountains of Jamaica, the present specific name has been given to our native fern by Brown. It is the variety (B.) of *Hymenophyllum Tunbridgense* (Sm. *Fl. Brit.* 1142.)

The foreign species *Trichomanes alatum*, described by Willdenow, has pinnate fronds, and the pinnæ oblong, acuminate, pinnatifid, and decurrent, with laciniæ cut, and dentate, ciliated on the margin, and the stipes alate, or bordered with a frondose membrane; a circumstance in which it agrees with the *Hymenophyllum Tunbridgense*, and has been one cause of that confusion of the two plants which has taken place. But the monophyllous involucrum, which is not dentate, proves the most solid distinction of this species of *Trichomanes* from *Hymenophyllum* for the external form in both genera is very much alike. In fact, the *Trichomanes* and *Hymenophyllum* differ so much in most respects from the rest of this great series, that were it not from their involucra, including the groups of capsules inserted into a receptacle within a cup, like the other genera of the *Cyatheaceæ*, they themselves might be considered as belonging to a distinct natural tribe; their elegantly delicate membranous and nearly transparent fronds giving them altogether a different character. Besides, none of them have erect stems; but, on the contrary, like the *Musci*, their stems are prostrate, creeping along the moist and shelving rocks, seldom rising above a few inches from the surface. Indeed, some species having their involucra on slender footstalks projected from the margin, and in the axils of the pinnæ of the frond, such as the *T. radicans*, *T. pyxidiferum*, *trichoideum*, and *muscoides*, possess more of the aspect of mosses than of ferns.

Several of these beautiful ferns have simple or undivided fronds. The *T. reniforme* has very entire stipitate kidney-shaped fronds. It is figured by Schkuhr, (*Crypt.* Tab. 134.) The *T. cuspidatum* has fronds about an inch long, ovate, bluntly pointed and truncate at the base; undulated, and crenate on the margin, finely veined, and bearing the cups towards the point, on the margin of the frond. The *T. membranaceum* has the fronds sessile, obovate, blunt, and as if torn on the margin. Plumier (*Americ.* 34. tab. 50, and *Fil.* tab. 101,) has figured this singular species, under the descriptive definition of *adiantum muscosum lichenis petræi facie.* It is also figured by Plukenet, tab. 285. *T. muscoides* is figured by Sloan, (*Jam.* p. 73. tab. 29, fig. 1.) under the definition of "*phyllitis scandens minima, musci facie.*" The frond of *T. scandens* attains the height of nearly a foot, and is among the tallest of the genus, and, like many others, it has the fronds three or four times pinnate. The frond of *T. giganteum* is also about a foot in length; the stem of these two, like all the rest, creeping along the surface Willdenow, in all, describes thirty-four species.

(6.) *Hymenophyllum.* (Willd. 1982. Smith, *Act. Taur.* 5. p. 418. tab. 9. fig. 8.)

Capsules in marginal groups, inserted into a cylindrical receptacle, included within a bivalve involucrum.

The only British species is the *H. Tunbridgense* of Smith (*Flor. Brit.* and *Eng. Bot.* tab. 162,) with the frond alternately bipinnatifid, and the border of the involucrum, and the frond itself, serrate; the cups solitary, and attached to the margin of the axils of the pinnæ. It is singular that this species should be also found in New Holland. It is figured by Labillardiere, (*Nov. Hol.* tab. 250). The remaining thirty-five species are natives of the West Indies and South Sea islands, and of Java, Mauritius, and Bourbon islands. Labillardiere mentions one, viz. *H. Australis*, from New Holland. To these, however, Brown has added two new species from the same country, viz. *H. rarum* and *H. nitens*, (vide *Prodr. Nov. Hol.* p. 159.) The *H. nitens*, has tripinnatifid, lanceolate, smooth fronds, linear obtuse submarginate, entire laciniæ; terminal involucra, with ovate orbicular valves.

The *Hymenophyllum rarum* again has bipinnatifid, lanceolate, smooth, and open fronds, the borders on the margin very entire; the under ones bifid; the involucra terminal, with round valves.

The *Hymenophylla*, as already observed, have all the habit or external appearance of *Trichomanes*.

XI. BOTRYCHIACEÆ (Plate CCLIV. Figs. 21, 22.)

The *Botrychium*, which we select as the type of this tribe, forms a link widely detached from the rest of this great series. It is included in the last edition of the *Species Plantarum* by Willdenow, with the *Lycopodium*, *Bernhardia*, and *Ophioglossum*, under *Stachyopterides*, with neither of which genera in fact it has any affinity whatever, if structure is regarded, as it necessarily must be the only solid basis of a natural arrangement. In external appearance, indeed, *Ophioglossum* slightly resembles this genus. The capsules in both are closely situated on spikes, and are globular and unilocular; but in structure they not only differ as genera, but belong to tribes totally distinct; and we shall afterwards be able to shew that the *Ophioglosseæ* have no relation whatever to ferns, whereas the *Botrychiaceæ*, it is clear, possess considerable affinity with the rest of this series. They have indeed neither rings nor striæ on their capsules. The intermediate links of the chain connecting them with the rest of the series are undiscovered, or probably lost; yet certain traces of mutual affinity are, notwithstanding, manifest between them, but accompanied in *Botrychiaceæ*, with marked peculiarities not hitherto observed in any of the known tribes of this extensive series.

The most striking peculiarity in the *Botrychiaceæ* consists in the circinate buds of the future plants being included within a membranous spathe, which bursts as they shoot from the subterraneous stem; whereas in the rest of the series, so far as hitherto observed, the buds are invariably covered with woolly scales. We are aware that Swartz has denied that the buds of *Botrychium* are circinate or involute, in which he has been followed by Sprengel; but having repeatedly dissected them, as represented in Plate CCLIV. Figs. 21. and 22, it is clear, that, in this respect, they nearly approach the rest of the ferns. There is as yet but one genus known,

Botrychium. (Swartz, *Synops. Fil.* 8.)

Capsules in a compound distichous spike, opening in a direction parallel with their insertion.

1. *B. lunaria.* This is the well known *Osmunda lunaria* of the *Sp. Plant.* Lin. p. 1519, and of Hoffman, *Germ.* II. 14. and Roth, *Germ.* 1. and 444. The stipes extending to the length of about five inches, with the frond bluntly pointed, attached towards the middle. The lobes of the pinnæ are crescent-shaped, nearly sessile, and imbricated, succulent, and of a deep green colour. The fruit-stalk, with its pendulous clustering capsules, rising above the solitary frond, possesses considerable elegance.

2. *B. rutaceum*, with the stipes bearing a single bipinnatifid frond, and the laciniæ obtuse, emarginate, bi or tridendate. This is the *Osmunda lanceolata* of Gmelin, (*Nov. Com. Petrop.* tab. 11. Fig. 2.) and (*Flor. Danic.* t. 18.) It varies with two fronds. It is found in woods in different parts of Europe. The *B. matricaroides* of the north of Europe, and *B. fumaroides* of North America, (Wild. *Sp. Pl.* 5. p. 62 and 63.) are evidently distinct from the two first named species; the fruit-stalk in both being naked.

The remaining six species enumerated by Willdenow, from their evidently different habits, require a closer examination. Whoever consults the accurate figure of *B. Zeilanicum* of the *Herbarium Amboinense*, tab. 68. Fig. 3, must be convinced that this supposed *Botrychium* has no real affinity with the present tribe, or with the rest of the series of ferns; for, like *Ophioglossum*, this species wants that peculiarity indispensible to true ferns, the circinate vernation of he fronds.*

FILIGRANE WORK, or FILAGREE WORK, from *filum* and *granum*, is the name given to a kind of ornamental work, in which flowers, &c. are formed of fine gold and silver wire, curled or twisted in a serpentine orm, and sometimes plaited, and worked through each ther, and soldered together.

This art appears to have been brought to Europe rom the East, and has been occasionally employed in ll ages. Such of our readers as take any interest in he subject, are referred to the following works, quoted by Beekmann in his *History of Inventions*, vol. ii. . *245—247*.

Halle's *Werkstate der künste*, i. p. 101; Jacobson *Technologisches Worterbuch*, i. p. 721; Grignon *Buletin des fouilles d'une ville Romaine*, i. p. 22.; Menage *Dictionnaire Etymologique*, i. p. 597; J. H. Jungius *Disquisit. de Reliquiis*; accedat Lipsanographia sive Thesaurus reliquiarum Electoralis Brunsuico-Luneburicus. Hanov. 1783, 4to. p. 19, 29, 56. Marsden's *History of Sumatra*, Lond. 1783, p. 145. Der Mitress Kindersley *Briefe van der Insel Teneriffa und Ostindien*, Leips. 1777. Thomans *Reiseund Lebensbeshreibung*, Augsb. 1788; and Von Stetten *Kunstgeshichte*, i. p. 489, and ii. p. 287. (*w*)

FILTER, is an apparatus employed to clarify imure water for domestic purposes; and it is also used n many arts, to separate the impurities from other luids. A filter acts as a sort of sieve or strainer, havng innumerable small passages through which the fluid an percolate slowly; but as the passages are not sufficiently large, to allow the particles of matter which are mixed with the fluid to escape, they are detained by he filter.

All springs of water which we are accustomed to call pure, are only rendered so by the effect of natural filtration; for the rain falling upon the surface of the earth, soaks first into the vegetable mould with which he surface is almost every where covered; in passing hrough this, it takes up not only dirt or earthy particles, but the remains of vegetable substances, which re in the progress toward decomposition; the water s thus rendered turbid and unwholesome for domestic urposes: such is the state of the waters of most rivers which are not supplied by springs alone, but by brooks unning on the surface. That portion of the water which soaks into the earth having passed through a ufficient thickness of porous strata, either by ascent or descent, will have all extraneous mixtures detained, nd become clear spring water. It should be observed, that filtration can only produce transparency, by rresting such particles of matter as are in a state of mechanical mixture with the fluid, for any matter which is held in chemical solution in the fluid will ass with it, through the pores of the most minute filer, unless the substance of the filter itself should have a greater affinity for such matter than the fluid which contained it. In this case, a new combination will be formed, and the matter in solution, leaving the fluid, will be taken up by the filter, not simply because the passages are too small to permit its particles to pass, but on account of the superior elective attraction between the substance of the filter and the dissolved matter.

Their action.

Filtration, on this principle, cannot continue to produce a natural spring for any great length of time; because, by the constant addition of matter, the filter will at last become saturated with it, or choked up. In applying this reasoning to springs, we shall find a reason why so few springs produce *pure water*, although it is always transparent. In reality, the great natural filters which produce springs, are almost always on an opposite principle, viz. that the substance which composes the filter has a great affinity for the water, and its particles are thereby taken up slowly in solution, and carried off at the same time that the extraneous matters, which are only in mixture with the water, are detained in the pores of the filtering strata: thus we find few springs which have not some mineral held in solution by the water, although invisible to the eye; and in cases where heat is generated in making the new combination we have spoken of, hot springs will be produced. The most common mineral taint which water receives in its natural filtration, is sulphate of lime or plaster of Paris: this renders the water *hard*, as it is called, so that it will not produce a lather with soap, but curdles it. Sulphate of iron or vitriol is also frequent in springs. Add to this, that in great towns, the drainage water which soaks into the earth is contaminated by animal matters as well as vegetable, and in such an offensive state, that the filtration through the soil can scarcely restore its purity. From all these causes, it is found that the turbid and foul waters of rivers, where altered by art to separate from their extraneous mixtures, will be more pure and wholesome as a beverage, than the generality of spring water.

Frequently impure.

Gravel springs.

Gravel, in thick beds, is the most perfect natural filter; and instances may be met with, of springs from gravel producing water very nearly as pure as distilled water. Sand, when white, such as that of the seashore, is also very good; but if coloured, it generally contains iron; and where the colour is deep, the iron is often in such excess, that it will be communicated to the water in passing through it. Beds of sandstone filter extremely well, and also some porous limestone.

Sand.

Filtering stones.

The ordinary filtering apparatus is made from a porous stone, of which there are two kinds; a sandstone procured in Northamptonshire, and a limestone found in Derbyshire. A thick bowl or basin is formed of the stone, and mounted in a frame. The foul water, being poured into the basin, drains slowly through the substance of the stone, and drops into a receptacle below, in a perfectly transparent state. When the water is foul, a small quantity of mud or slime is found to collect at the bottom of the basin, and must occasionally be cleared out; but in the course of time, the more minute impurities will insinuate themselves into the pores of the stone, and at last clog up the passage of the water. This is remedied by chipping away the interior surface of the stone one-half or three-fourths of an inch, because the impurities do not penetrate deep, er into the stone; this will restore its action for a long time. We do not approve of the ordinary figure of the filtering stone, which is that of a bowl, because the pressure of the water is unequal in every part: it would be a preferable form to have a vessel of wood, lead, or pottery, and fitted with a bottom, formed from a flat slab of the filtering stone; and this method would admit of constructing a much larger filter than can be done in the form of a bason of solid stone.

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* The Editor has been indebted for the preceding article, to JOHN YULE, M. D. F. R. S. E.

Mr Moult's filtering stone.

The Society of Arts have published a description of a filter by Mr Moult, which consists of a vessel in which the foul water is contained, and a bason of filtering stone being placed in it, the water will percolate through the stone into its cavity, from whence it can be taken up clear and fit for use; or the filtered water may be drawn off, by means of a curved leaden pipe, to reach over the edge of the bason and act as a syphon, with a cock at the lower end. By this plan of filtering the water into the bason, the deposit is not left on the stone, and will therefore be less liable to clog up its pores. The same principle was proposed by Mr Collier; his machine consisted of a cask, or other vessel to contain the foul water. Within this vessel cylindrical tubes of earthen ware are fixed; these tubes are closed with a hemispherical end, but the other end, which is open, is applied to the sides of the vessel, and closely luted thereto, so that no water can gain entrance into the vessel, without first penetrating through the substance of the tube. A cock was provided in the side of the vessel, opening within the tube to draw off the pure water. Mr Collier proposed also to fill up the vessel with pieces of broken pottery, which, by presenting a great surface, would allow every facility to the deposition of the gross impurities of the water, and thus avoid the clogging up of the filter, and also render the process more expeditious.

Mr Collier's.

Mr Hempel's.

A patent was granted in 1790, to Mr Hempel for a method of making filtering vessels or basons, from a species of pottery, the composition of which was four parts of tobacco pipe clay, mixed up with five of coarse sea, river, or drift sand. For large vessels, this composition is found liable to crack in the burning, equal parts of the clay and sand were therefore recommended; and if this was found insufficient to prevent the tendency to cracking, one-ninth part of Stourbridge clay, or of old crucibles broken down and pounded, was to be added: the basons were turned in a potter's lathe, in the usual manner.

Harman & Dearn's gravel filters.

The filtering stones most commonly used are not the best kind, as they are too expensive, liable to be broken; and will not produce so great a quantity of filtered water as others, which, in imitation of the great natural filters, have beds of gravel and sand for the water to pass through. A very simple apparatus for domestic use, consists of a cylindrical vessel of pottery, provided with a cock to draw off the clear water; upon this is fitted another cylindrical vessel, having a globular bottom, which is pierced with small holes; a stratum of coarse gravel is first spread in the vessel, over this a stratum of fine gravel, and above this fine sand. If the bottom of the vessel is covered with a coarse cloth, to keep the sand from running through the holes in the bottom, the gradations of gravel and sand will be rendered less necessary. A plate of earthenware, or a board, is laid upon the sand, and being perforated with holes, allows the water to pass, but prevents the disturbance of the sand when the foul water is poured in upon it, and in persolating through the sand it is filtered. The fineness of the sand and the thickness of the bed will be regulated by experiment; and it is one of the greatest advantages of this construction for a filter, that it can be so readily adapted to the degree of filtration which the water requires, the bed being made thick if the water is very foul, and diminished in proportion to its purity, by which means the greatest quantity of water can be passed through this filter. The sand should be changed every fortnight or three weeks, to keep the apparatus perfectly sweet and clean.

Mr Bramah's.

The late ingenious Mr Bramah, had a patent for various modes of conveying and drawing off beer and other liquors, in which he describes a filtering apparatus which he proposed to place in the pipes to conduct the liquor. This was a cylindrical vessel, made of copper, tinned within, or of any other materials; the upper end was closed by a lid screwed on by a flaunch, and the lower end terminated in a cone; a pipe was introduced to the vessel near the lower part to introduce the liquor, and from near the upper end a similar pipe proceeded to convey it away. Between these two was fixed the filtering floor, consisting of flannel, sand in bags, sponges, or other similar substances, which were spread upon a horizontal plate pierced full of small holes, and fixed in the cylinder above the filtering substance; another similar plate was fixed and screwed down to confine it. The liquor was introduced by the lower pipe by means of a pump or otherwise, and ascending through the filtering floor, passed off in a clarified state: the impurities which are separated collect in the conical bottom of the cylindrical vessel, whence they can be drawn off by a cock. This contrivance is adapted to give a slight filtration to a great quantity of liquor, such as beer.

Mr Peacock's filter by ascent.

In 1791, Mr Peacock took out a patent for a method of filtering water in the large way, for the service of towns, &c. His principle was to cause the water to ascend through the filtering medium, instead of descending; and the apparatus, except as to dimensions, very nearly resembled Mr Bramah's, being a vessel divided in two by a horizontal grate or partition, upon which the filtering medium was spread in layers, and the lower division had a communication with a more elevated reservoir, from which the water flowed and rose through the filtering bed. Mr Peacock proposed to use for this, sandy gravel, sand, broken and pulverised glass or pottery, &c. These were to be prepared by repeated washings, and then sorted by sieves into a number of different sizes; these are to be spread in different layers, beginning with the largest and spreading the smaller particles over these, in a regular gradation, until the finest is at the top. This arrangement is better than that we have before spoken of, when the water first passes through the finest, being less liable to choke up.

Pounded glass.

Syphon filter by sand.

Professor Parrot of Paris, invented a filter with sand, acting both by the ascent and descent. It is described in the *Philosophical Journal* to consist of a bent tube, like an inverted syphon. It is curved to nearly a semicircle; this is filled with sand, and the water being introduced into the longest or upper leg of the tube, filters through the sand, and passes off. At the top of the lowest leg, it is recommended to have three inches of difference between the level of the two surfaces of the water, and eighteen inches of pure sand for the water to pass through. When the section of the tube was four inches by two, that is eight square inches, it would pass six Paris pints of pure water every hour.

Char

Mr John Isaac Hawkins has contrived a filtering apparatus, which we consider as better adapted for domestic purposes than any which we have seen. It consists of a vessel pierced with holes, and placed over another, into which the filtered water is to be received. A layer of pounded charcoal is spread in the bottom for the water to filter through; the lowest part of the layer is to be composed of charcoal, pounded as fine as coarse sand; and above this, other pieces increasing in size, till the largest, which are as large as pease; the whole is covered with a board pierced with holes to admit the passage of the water, but, at the same time, to prevent the charcoal being disturbed when the water is poured in. Another form of the apparatus is very well adapted for the use of a ship's company. It consists of a cask divided by a vertical partition, which does not quite reach the bottom, but leaves a space for the passage of the water. The bottom of the cask is filled with powdered charcoal, so as to reach some inches above the space at the bottom of the partition. The foul water being poured into one of the divisions of this cask, is filtered in passing to the other, by being obliged to descend through the charcoal on one side, and ascend through the other. This machine affords a great quantity of water; and the known antiseptic quality of the charcoal is of great consequence in removing any taint with which water is often affected, and which is not easily removed by any other filter, unless indeed it is made very fine, such as a thick filtering-stone, and this will permit the water to pass but very slowly.

lotting aper.

The most simple filter for experimental inquiries is made by a piece of blotting paper, rolled up to form a conical funnel, and twisted tight at the point, so that the fluid cannot pass, except through the pores of the paper. This funnel is to be placed in the neck of a wide-mouthed bottle, and filled with the liquor, which will filter through the paper, and drop slowly from the point of the cone in a very pure state.

otton reads.

Another method, which is still more delicate, is performed by capillary attraction as well as filtration. For this purpose, a glass is filled with the fluid nearly to the brim, and a bunch of coarse cotton threads, such as are used for the wicks of lamps and candles, is hung over the edge, so that one end of the bunch is immersed in the liquor, and the other hangs over a small bottle or other vessel destined to receive the clear fluid. In this way it will be drawn up on one side, and conveyed through the cotton, from the ends of which it will drip very slowly, but in a most perfect state of purity from all extraneous mixtures. It is scarcely necessary to mention, that the cotton must be wetted with the liquor, or the ascent will not begin when it is first put in action. A piece of thick flannel, if it is doubled three or four times, will answer the same purpose particularly well.

ood.

A very ingenious filtering apparatus has recently been invented by Mr James Innes of Edinburgh. A piece of wood is placed within a cylinder, containing the water, which is forced through the pores of the wood by the pressure of a forcing-pump. Mr Innes has employed this simple machine for purifying oil and other fluids.

For an account of Amy's filtering machines, see *Mem. Acad. Par.* 1745, Hist. 82; 1748, Hist. 121; and *Machines Approuvées*, tom. vii. p. 280; Hempel, *Repertory of Arts*, vol. ii. p. 230; Collier, Tilloch's *Phil. Magazine*, vol. vi. p. 240; Peacock, *Repertory of Arts*, vol. xi. p. 221; Harman and Dearn, Nicholson's *Journal*, vol. viii. p. 126; Parrot, Nicholson's *Jonrnal*, vol. ix. p. 40; Sir H. Englefield, Nicholson's *Journal*, vol. ix. p. 95. See also *Repertory*, vol. xiii. p. 140; and Gilbert's *Journal der Physik*, vol. xiii. p. 108. (J. F.)

FINDER. See TELESCOPE.

FINE. See LAW.

FINEERING. See VENEERING.

FINGER-KEYED INSTRUMENTS, in Music, are in general such as are performed upon by touching with the fingers a system of levers, called keys, manual keys, or the clavier. The organ, virginal, spinet, harpsichord, piano forte, and barillons or carillons, are well known in this class of instruments. Mr John Isaac Hawkins, a few years ago, invented a new instrument, consisting of a rotative bow of horse hair, that could be made to act at pleasure upon catgut strings, which he denominated a *Finger-keyed* vial or claviole. M. Chladni likewise invented a new instrument, called a *Keyed Cylinder*. See the *Monthly Magazine*, vol. xxviii. p. 514.

The ordinary form and arrangement of *Finger-keys* are found well adapted to the diatonic scale, or that in which five notes and two half notes are comprised in the octave, two whole notes or long keys being associated together, and three such, with a half tone between each of these groups, which are separately called a *ditone*, and a *tritone* by Dr Callcott. In the former of these groups, two shorter keys of a different colour (now usually black, the long keys being white,) are inserted between the long ones; and, in the tritone, two such short keys are interposed, by which the whole douzeave, or range of 12 half notes in the octave, is completed, and every other octave, above and below, is but a repetition of the first.

The most conspicuous and best marked finger key in the arrangement above described, is the long one in the middle of the ditone, which belongs to the letter D, which is the second of the natural key; beginning therefore at C, the letters belonging to each of the finger keys are as follows: viz.

$$\begin{array}{cc} C\sharp\ E\flat & F\sharp\ G\sharp\ B\flat \\ \underbrace{C\ D\ E}_{\text{Ditone.}} & \underbrace{F\ G\ A\ B\ c}_{\text{Tritone.}} \end{array}$$

Although three of the short notes above are described as *sharps*, and two of them as *flats*, yet common instruments are obliged to be so tuned, that every short note may indiscriminately serve either for the *sharp* of that on its left hand, or for the *flat* of that on its right, and even so that E and F, and B and c, may also serve as the flats or sharps of each other respectively.

This very confined nature of the key-board, or system of finger-keys, long presented a serious bar to improvement in the tune of these instruments with fixed tones, until at length Mr Hawkes produced his patent instruments, on which all the five short notes might be tuned to *sharps*, and, by means of a pedal, the connection of the keys with these strings or pipes might be instantly loosed, and the same short keys be made to act on another set of those tuned to *flats*, thereby introducing 17 sounds in the octave, but with the disadvantage of being unable to use a flat of any one note and a sharp of another at the same time. But these and other defects the patent instruments of M. Loeschman and of Mr Liston now remedy, by means of several pedals, adapted to take away two sharps at a time at one end of the scale, (See our article *Succession of* FIFTHS), and to supply to the same finger-keys two flats in the place of them, in the order of modulation: thus, for instance, out of the original scale that we have represented above, the first flat pedal will remove G♯ and C♯, and supply in their places A♭ and D♭; the first sharp pedal will remove E♭ and B♭, and replace their connection with the short finger-keys, by D♯ and A♯, and so on, leaving the performer all the present uses of the finger-keys, except during the instants when the pedals are in motion.

However perfect and easy the use of the present key-board may seem to practised musicians without the pedals above mentioned, a desire has long existed for simplifying it for the use of children and beginners.

Finger-key Intervals.

This the late Mr Charles Clagget attempted by his *equal keys*; and more recently Mr Trotter took out a patent for a key-board, better adapted to the use of beginners, and for transposing or playing music in a different key from that in which it may be written. See the details of this latter invention in the *Repertory*, vol. xxii. p. 197. (ɛ)

FINGER-KEY *Intervals*, in Music, or degrees of the stave or scale, are very commonly denominated half-notes, half-tones or semitones, and *considered as equal among themselves!* as though the *Isotonic* system was alone in use, notwithstanding the high probability, which has often been mentioned, that an *equal temperament* has never yet been heard on the organ, rarely so (or very near it) on the piano-forte; and it is certain that this system never was, or will be, performed by the voice or violin. It is, however, of considerable use to the musical student, to be able to class the great number of musical intervals which present themselves according to the finger-key of his organ to which they severally belong, and by which they can alone be brought into use on that instrument, while the key-board remains limited as at present. Fortunately, the new notation which we use, enables us to make this classification without any trouble, because every interval, regularly expressed in Farey's *Notation*, (See that article), has the f's therein equal to its number of finger-key intervals, *artificial half-notes*, or chromatic semitones of Callcott, as the following table will fully explain, viz.

1	2	3
	13	♭IX 9 ✱VIII
637		
	12	♭9 VIII ✱8
590		
	11	♭VIII 8 VII
533		
	10	♭VII 7 ✱VI
486		
	9	♭♭VII ♭7 VI ✱✱V
429		
	8	♭VI 6 ✱V
382		
	7	♭♭VI V ✱IV ✱✱4
328		
Σ	f	Numerals

1	2	2
328		
	6	♭V 5 IV ✱4
278		
	5	♭IV 4 ✱III
231		
	4	♭4 III ✱✱II
174		
	3	♭III 3 ✱II
127		
	2	♭♭III ♭3 II ✱✱1
80		
	1	♭II 2 1 ✱1
23		
	0	♭I ♭2 1
0		
Σ	f	Numerals

This Table has three columns, numbered at the top and titled at the bottom, the first of which shews the number of Σ's, in the least interval that has 1, 2, 3, &c. f's respectively, in col. 2; or, such Σ's in col. 1. may be considered as the limits between the different finger-keys numbered 1, 2, 3, &c. in col. 2. In col. 3, sometimes 3 and sometimes 4 intervals, numerally expressed with the addition of ♭'s and ✱'s, are set down as belonging to each finger-key; such pairs of these intervals as are linked together, are of equal value, respectively, in Mr Liston's euharmonic scale. Each of the finger-keys on Mr Liston's organ, yield occasionally five different sounds, except the ninth, or A key, which produces only four sounds, making in all 59 sounds in the octave. (ɛ)

Finland.

Situation.

FINLAND, a division of Sweden, but recently annexed to Russia, is situated between 60° and 66° 23' North Latitude, and between 21° 20' and 31° 20' East Longitude from Greenwich. It is bounded on the north by Swedish Lapland; on the west by the Gulf of Bothnia; on the south by the Gulf of Finland; and on the east by the Russian territories. It is divided into seven provinces; namely, the Aland Islands, Finland Proper, East Bothnia, Tawartland, Nyland, Sawolax, and Keymenegard. The Aland or Oeland Islands, about 80 in number, and generally small, are situated at the mouth of the Bothnian Gulf, between Upland and Finland Proper, and in 1792 contained 11,260 inhabitants. The largest, named Aland, is about 14 leagues in length, and five in breadth; and its principal town, Castleholm, is remarkable only for its ancient fortress, where the unfortunate Eric XIV. was imprisoned in 1571. The inhabitants of these islands, who appear to have been originally Laplanders and Fins, live to a very great age; and about 298 of them are registered as sailors, whose pay from the government amounts to about 5000 rixdollars yearly. In most of these islands, though included in the government of Finland, the Swedish language is spoken by the people; and the Finnish tongue begins to be heard only in Helsing.

Divisions.

Finland Proper.

Finland Proper, the south-west province, extends about 60 leagues from north to south, and between 25 and 33 from west to east. It is agreeably diversified with lakes, rivers, woods, arable fields, and pasture grounds; and, though inadequately cultivated, is tolerably fertile. Its towns, which are all situated on the coast, are, Abo, the capital of the province, a bishop's see, and the seat of a university, about 41 Swedish miles N. E. of Stockholm, and containing about 8750 inhabitants; Nystadt, a small trading town with a good port, north of Abo, and surrounded by a pleasant tract of country; Biorneborg, an ancient but insignificant sea-port; and Nadendal, a little town to the north of Abo.

East Bothnia.

East Bothnia, or Cajania, extends along the gulf of that name to the northern extremity of Finland, and is upwards of 100 leagues in length, and between 30 and 70 in breadth. The country on the coast is level and marshy, and a ridge of hills runs along the south and east boundaries of the province. The towns, as you proceed northwards, are, Christinastadt, a small place near the south border, with a harbour of difficult entrance; Wasa, a sea-port town, rapidly increasing in trade, provided with a tribunal of justice for the north of Finland, and containing, in 1790, about 4000 inhabitants; Gamla Carleby, a small but regular town, about 34 leagues S. W. of Uleaborg, situated in a sandy and marshy country, and containing about 1400 inhabitants; Brakestadt, a small sea-port, which carries on some trade, contains about 800 people, and is about 20 leagues north of the last mentioned place; and Uleaborg, the capital of the province, a trading town at the mouth of the rapid river Ulea, with a very bad harbour, containing about 4000 inhabitants, and celebrated for its exports of salmon and tar; Tafwartland, or Tavastia, situated to the eastward of Finland Proper, is about 80 leagues in length from south-west to north-east, and between 20 and 30 in breadth. It is the most fertile and beautiful district in Finland, but is very thinly inhabited, and poorly cultivated. It is mountainous towards the north; and towards the south full of lakes, one of which, named Pajana, is 80 miles long, and 15 broad. Its principal and almost only town is Tanasthus, or Kroneborg, a small place, situated in a fertile spot on the banks of a lake, about 28 miles N. E. of Abo.

Nyland stretches along the north coast of the Gulf of Finland about 40 leagues, and is between 15 and 18 in breadth from north to south. It is level, fertile, and in some parts tolerably cultivated. Its towns are, Ekenas, a small sea-port, about 50 miles south-east of Abo; Helsingfors, the capital of the province, provided with a good harbour, and defended by an immense fortress, called Sweia Borga, standing on a rocky island at the entrance of the port, capable of containing 7000 men, and designed as a bulwark against the encroachments of the Russians; Borgo, a small but ancient town, about 10 leagues eastward of the last mentioned, pleasantly situated on a hill, and containing a university, or rather academy, taught by seven professors; Lovisa, or Degerby, formerly the frontier town between Russia and Finland, built in the midst of a remarkably stony or rather rocky country, but provided with a very convenient harbour.

Sawolax, an inland province to the north of Nyland, xtends about 70 leagues from north to south along the onfines of Russia, and about 80 from west to east. It s covered with forests, rivers and lakes. The lake of aima, which is nearly 160 miles in length, and 25 at s greatest breadth, lies partly in this province, and artly within the Russian territories, and has a com- unication with lake Ladoga by means of the rapid ver Voxen. Its principal town, Nylot, is situated ear the south border.

Keymenegard, which lies on the south-east extremi- of Finland, is naturally fertile, but thinly inhabit- l, and almost destitute of cultivation. Its chief town Kuopio; but the districts of Carelia and Kexholme, ce belonging to this province, have long been inclu- d in Russian Finland.

Russian Finland, forming the province of Wybourg, s ceded by Sweden, partly in 1721, at the peace of stadt, and partly in 1741, by the treaty of Abo; and tains six districts,—Wybourg, Fredericksham, Wil- nestrand, Nyslot, Kexholme, and Sardobol. The ole of Finland, indeed, is now to be included by the grapher, within the wide extent of the Russian em- e. After having been the scene of many bloody ggles between the Swedes and Russians, it was com- tely overrun by the latter power in 1808, and soon r formally ceded by treaty. It was lost by the folly incapacity of the late monarch of Sweden, who its brave defenders to sink under an overwhelming e, while he was vainly intent upon the reduction orway and of the Danish islands in the Baltic.

inland contains about 48,780 square miles, and ,000 inhabitants. It is covered with numerous s, which give rise to several rivers, generally rapid, soon reaching the end of their course. The chief ese are the Ulea at Uleaborg, which is navigated by trading vessels, though its stream is so rapid, that the ships run down the river at the rate of 18 English miles in the hour; the Cano, which passes Biorneborg; the Aurajoki at Abo, about 100 yards broad, and remarkable for its muddy waters; the Kymen, which flows into the middle of the Gulf of Finland, and forms the boundary between Swedish and Russian Finland.

Mountains.

The mountains of Finland often contain a brown mixture of felspar and mica. Lead ore is found in various parts, and a ferruginous earth from which iron is extracted.

Forests.

There are, in many places, very extensive forests, and one particularly to the north of Abo, about 80 miles in length. Great devastations are occasioned in these forests by the tempests of winter, which seem to find access to the very centre of the wood, by descending in the manner of a tornado, and which tear up by the roots, or break in the middle of the trunk, or bend to the earth, the most enormous pines. Frequently also similar ravages are committed by conflagrations, occasioned by the carelessness of the peasants in smoking their pipes and making fires in the woods; and sometimes, it is suspected, intentionally kindled, from an interested motive, as the inhabitants are allowed to cut down, for their own use, any trees in the king's forests, which have been injured by the burning.

Climate.

The climate and seasons of Finland vary considerably in different parts of the country, according to their latitude and situation. At Uleaborg, which is the most northerly town, the winter commences in October and continues to the end of April. The spring is limited to the month of May; the summer begins in June, and lasts three months; the autumn, like the spring, is confined to one month, and both commences and terminates in September. Even in summer the night frosts are pretty sharp, particularly about the middle of August; and in the end even of July, the pot herbs in the gardens have been known to suffer from the frost. From the beginning of summer, however, the progress of vegetation, as in most other northern latitudes, is remarkably rapid; and there have been instances of grain being sown and reaped in the neighbourhood of Uleaborg, in the space of six weeks. In the southern parts of the country, near the Gulf of Finland, the heat in summer is equal to what is generally experienced in Portugal; and the long continuance of the sun above the horizon increases the temperature above that of more southern countries. At Uleaborg, the middle temperature of the four seasons, according to a mean proportion of 12 years, was found to be in winter 10 degrees below zero, in spring and autumn six degrees above the freezing point, and in summer 15°.

Soil.

The surface of the country, besides what is occupied by large lakes and forests, is frequently covered with marshes and masses of stone; but not more so than other parts of Sweden, and, excepting East Gothland, is not less fertile and populous. The soil is generally of a sandy nature, or clay; and it is only in the valleys or banks of rivulets, that the proper earthy mould is to be seen. Finland, however, presents to the view many rich pastures, and fields of grain, particularly of rye, oats, barley, and even wheat. The principal exports of the country are salt, iron, copper, pitch, tar, deals, rye, butter, oil of seals, skins, tallow, salt-beef, dried fish, and vessels built of fir; but the mode of agriculture and kinds of produce are so similar to those of Sweden in general, that we refer to the account of that country for a more particular statement on the subject. It may here, however, be remarked, as a curious circumstance, that the Finnish plough is of a very ancient model, and resembles the primeval instrument of agriculture in Egypt and other eastern countries. Its form is that of an alpha placed horizontally, and having one side shorter than the other ∢, which, being tipped with metal, enters the ground, while the cattle are attached to the longer limb: (See Clarke's *Travels*, vol. iii. p. 216.)

Inhabitants. The Fins appear to have been the original inhabitants of Sweden, and to have proceeded from their settlements around the White Sea, a country formerly styled Permia, or Biarmia, and still exhibiting remains of their ancient prosperity. They are short in stature, with flat faces, dark grey eyes, a thin beard, tawny hair, and a sallow complexion; but those who inhabit the more southern and western districts of Finland, while they retain the national features, have a superior appearance, and are scarcely to be distinguished in their manners from the Swedes. In Russian Finland, however, they have a slowness of motion, a depression of spirits, a simplicity, and almost stupidity of look, which form a striking contrast with the lively aspect, alert movements, and cheerful humour of the Russians; but these circumstances may be chiefly owing to their condition as a conquered people, imitating and dreading their masters. More hardy than the Muscovites, they are not so warmly clothed, and seldom wear the sheep skin; but have a coat of coarse woollen stuff, made without regard to shape, and tied round the body with a band, a pair of coarse linen drawers, or loose pantaloons, straw shoes, and pieces of woollen cloth, or ropes of straw wrapped round their legs.

Language. It is chiefly in the northern parts of Finland, or rather in Lapland, that the ancient Finnish language is heard. Along the gulfs of Finland and Bothnia, the Swedish language prevails in the towns; and the peasantry speak a mixed dialect of both tongues. The Fins were subjugated by Eric IX. King of Sweden, and converted to the Christian faith in 1156; and from that period, literature, especially poetry, began to be more generally cultivated among them. **Poetry.** The verse which they employ is called Runic, in which the lines consists of eight syllables, a long and a short in succession; but, instead of terminating in rhymes, they begin with alliteration, having at least two or more words which agree in the same letter or sound, as in the following specimen:

Nuco nuco pico linto
Wessi wessi wester eki.

These Runic verses are rarely committed to the press, or even to writing, but are chiefly transmitted by oral communication; and none are found of an earlier date than the era of the Reformation.

In the more inland districts, the peasantry are much addicted to this species of composition; and many of them, unaided by education, are capable of producing these verses on ordinary subjects, sometimes in a great measure extempore. The recitation or composition of such songs, sometimes accompanied with the harp, forms one of the most frequent amusements of the country people at fairs and private meetings. On these occasions, the reciter or poet stands in the midst of a circle of auditors, and having sung or delivered one line, a coadjutor, taking up the last word, or the last but one, finishes the line along with him, and then repeats it alone; which gives the speaker time to recollect or compose the succeeding line, which he then sings, and his assistant repeats in like manner, until the poem is ended.

The Finnish language abounds in proverbs, bearing much resemblance in their form to those of Solomon, and generally expressive of sound sense and acute remark. They are mostly in Runic or alliterative verse, and divided into two hemistichs, the latter of which contains an illustration of the former. "A good man spareth from his peck, but the wicked will not give from a bushel."—"The wise man knoweth what he shall do, but fools try every thing."—"The work is ended which is begun; there is time lost to say 'what shall I do?"—"The tool of the industrious man is sharp, but the plough-share of the fool wanteth grinding."

Music. The inhabitants of Finland are not less sensible to the influence of music; but, owing probably to the imperfection of their national instrument, they have not made much progress in the art. Their native instrument, the *harpu*, consists of five strings or chords of metal, each of which sounds a distinct note, *a, b, c, d, e*, and within the compass of these five notes, the whole of their music is confined. But the violin has been introduced in later times; and the music of the Finlanders is beginning to acquire a more varied character.

Their dancing consists in the most rustic jumping, without any variety of step or motion, except alternately laying the arms over each other; and the whole exercise is performed with sufficient vigour, but with entire gravity, and most unexpressive countenances.

Houses. The houses in Finland, and frequently even the churches and other public edifices, are constructed of wood, generally painted red; but they are nevertheless sufficiently warm, and sometimes too much so for the feelings of those, who are not accustomed to a close atmosphere. The habitations of the peasants are well built, and afford complete protection from the severity of the winter cold; and, notwithstanding the long duration of that season, and the seeming sterility of the soil, the people are in many respects better provided than the same class in more southern regions. They can generally set before the traveller at least fresh and curdled milk, salt herrings, or a little salt meat; and they are rich in all that they consider as constituting the enjoyments of life. If at any time they have more money than their immediate wants require, they either lay it up for future emergencies, or convert it into some domestic utensil; and it is not uncommon in a small wooden dwelling, to see the water presented in a silver vessel of the value of 50 or 60 rixdollars. **Dress.** The women are warmly clothed, and above their other garments wear a large linen shift, which gives them the appearance of being in an undress. In the house, the men generally throw off their coat, and even in that manner perform their ordinary labours in the open air; but when they go out to a greater distance in the winter season, they wear a kind of short coat made of calfskin, or a woollen surtout, fastened round the middle with a girdle; and pull over their boots coarse woollen stockings, both for warmth and for safer walking on the ice. Most of the peasants have a small house for the purpose of taking the warm bath, which is done in the following manner. **Baths.** A number of stones in the innermost part of the chamber are heated by fire till they become red; and water being thrown upon them in this state, the bathers are involved in a cloud of thick vapour, in an atmosphere of 70 or 75 degrees of Celsius. In this heated and oppressive air, they remain naked for the space of half an hour or even a whole hour, rubbing their bodies, or lashing them with bunches of twigs; and frequently go out without any covering to the open air, or even roll themselves in the snow, when the degree of cold is 20° or 30° below zero; thus making an instantaneous transition of 100 degrees, which is almost equivalent to a passage from boiling to freezing water. This practice, they affirm, has a most invigorating effect upon their frames, and recruits their strength as much as rest or sleep.

The Finnish peasantry are at all seasons busily employed in active labour; and even in the depth of winter find abundance of employment both in the house and abroad. Within, they are engaged in making nets, constructing cart wheels, forming faggots for fuel, or threshing their corn; and out of doors, they cut down timber, and easily drag over the ice or snow such enormous trunks as they could scarcely be able to move in summer. Fishing and hunting may be considered as their necessary avocations, rather than voluntary amusements. In fishing with hooks, they scour over the ice n long wooden pattens, pushing themselves along with ncredible velocity, by means of a pole which they hold n their hands; and when they have reached the place where they intend to fish, they spread a triangular sail to shelter them from the wind, perforate the ice with a chissel, plunge their line into the sea to the depth of about 30 feet, and are sometimes obliged to continue stirring the surface of the water to prevent it from freezing. In fishing with nets, they make two openings in the ce, and by means of ropes and long poles pass the nets from the one to the other, which they afterwards draw out with great labour. In autumn, when the frost begins to set in, and the ice is most transparent, the fisherman courses along the rivers with a wooden club or mallet in his hand; and when he observes a fish under the ice in shallow water, he strikes a violent blow perpendicularly above it, which at once breaks the ice and stuns the fish, so that he easily seizes it with an instrument made for the purpose. In hunting the seals, they take post in the neighbourhood of their haunts, behind a mass of ice, and wait till one of them comes out of the water. It frequently happens, that the hole in the ce by which he ascends is frozen over almost instantaneously; and the hunters then fall upon him, before he has time to make a new aperture with his breath, or at least before he can reach the opening, should it still be passable. In these extremities the animal makes a desperate resistance, seizing the clubs with his teeth, and attempting to reach the assailant; but the slowness of his motions renders his efforts unavailing, and he is oon dispatched without much risk. The Finlanders' mode of hunting the bear requires a greater degree of ntrepidity and presence of mind. Instead of a musket, which might be injured by the damp, and prove a very uncertain weapon, the hunter uses an iron lance fixed at the end of a pole, and having a cross bar about a foot distant from the point. When the bear has been irritated to rush from his den, and is rearing himself on his hind legs to seize his daring antagonist, the peasant drawing back the iron lance close to his breast, so as o conceal the length of his weapon, and render the animal less watchful against its stroke, advances boldly within arm's length of the bear, and plunges the point nto his heart. The cross bar prevents the lance from passing through the body, keeps the animal from reaching the hunter with his paws, and serves to throw him on his back, while the wounded bear hastens his own death by holding the weapon fast, and pressing it more deeply into the wound. A still more hazardous enterprise is the seal hunting in the spring, after the frozen ea breaks up, and the ice floats in shoals upon the surface. Four or five persons set sail in an open boat with one small mast; and expose themselves during the space of a month or more, and in the most unfavourable circumstances, to all the dangers of the ocean. In this pursuit their little bark is continually placed between masses of ice, which threaten to crush it to pieces; and in order to reach the seals, they must creep along the floating shoals, killing them as they repose upon the ice. During the same season they hunt the squirrel, which they kill with a blunt wooden arrow, shot from a cross-bow, that they may not injure the skin. The bow used in this sport, is of a very ancient construction, extremely heavy, and requiring great strength to bend it, even with the assistance of a thong. The peasantry are remarkably dexterous both in the use of this bow and of the fowling-piece, loading the latter always with ball, and rarely missing the smallest bird. They employ for this purpose a kind of rifle gun with a narrow bore, which requires but a very small charge, and yet carries to a considerable distance. The winter also is the principal season of traffic; and all the great fairs are held in Finland and Sweden in that time of the year, in consequence of the facility of carrying goods over the ice, and travelling in sledges on the snow. The peasants on these occasions frequently undertake journies of three or four hundred English miles, carrying along with them whatever articles they have for sale. In Finland, the sledges are very narrow, containing only one person, and drawn by a single horse; and the roads are deep ruts formed by the successive passage of these vehicles, thus admitting none of a larger size than what are generally used in the country. The circumstance of being overturned is rarely productive of any serious consequences; and the dangers attending the traveller arise chiefly from those parts of the rivers or lakes where the ice is insufficient to support the weight. Excepting the bear, which rarely comes from his den to attack the inhabitants, until he is first provoked, the only other savage creatures in the country are wolves; and those, even when starving, will not venture singly to assail the passenger. When assembled, however, in herds, and impelled by famine, they sometimes rush upon the horses in the sledges; and should the traveller be overturned and left upon the road, he must fall a prey to their ferocity.

Winter travelling.

Customs.

Many strange and sometimes indelicate customs prevail among the inhabitants, some of which will come more properly to be noticed under SWEDEN, as being common to both countries, and others of them under LAPLAND, where these ancient peculiarities have suffered least change. A Finlander, when about to form a matrimonial connection, commissions some old women to make known his proposals to the object of his affections, at the same time sending a present of a handkerchief, ribband, or piece of money. The messenger waits upon the young woman while undressing at night, and after dwelling on the praise of the lover, slips his gift into the fair one's bosom. If the present is retained, the young people consider themselves as mutually engaged, and nothing but the marriage ceremony is wanting. But if the present be returned, this indicates a refusal, which may nevertheless yield to a second proposal, unless the young woman, instead of returning the gift with her hands, suffers it to drop to the ground, which is counted a positive token of decided rejection. At the marriage, one of the friends or neighbours, with the orator or speaker, does the honours of the feast, who generally also recites verses, or makes them extempore suitable to the occasion; and, on the day following, after addressing some advices to the married couple, he strikes the woman repeatedly round the body with the husband's breeches, commanding her to be fruitful, and to furnish him with heirs of his own body. In some places, a practice resembling the *bundling* of the Americans, is said to exist. Both in the towns, and among the peasantry of Finland, a stranger experiences the utmost kindness and hospitality. He is always treated as the first person in the company, and every endeavour is made to consult his taste and gratify his feelings. Even among the principal inhabitants of the towns, a strange and rather startling mode of testifying satisfaction with a visitor, is practised by the ladies, who, as soon as the entertainment is concluded, give him a slap upon the back when he is least expecting it; and the more forcible the application of the hand, the stronger is the declaration of good will. The peasants display great disinterestedness in their services to strangers, and can seldom be induced, without considerable importunity, to accept a pecuniary remuneration for any occasional assistance, which they may have rendered. See Coxe's *Travels in Russia, &c.*; Acerbi's *Travels in Sweden, &c.*; Wraxal's *Tour round the Baltic;* Swinton's *Travels into Norway, &c.*; Clarke's *Travels,* vol. i. (*q*)

FIRE-Escapes, are machines for enabling persons to descend from the windows of a house when it is on fire, and when the stair-case and passages are so filled with the flame or smoke, as to prevent a retreat by the ordinary avenues: Some of these machines are contrived to convey down valuable goods as well as people.

A person who is awakened from a profound sleep by the flames of a fire, which has already made such progress as to cut off all retreat, has no other alternative than leaping from a window, perhaps of great height, or perishing by the flames. This is a situation so dreadful, as to demand every exertion of ingenuity, and every regulation of the police, which can contribute to the relief of the sufferer. Frequently as this tragedy is repeated in London, every new instance makes a lively impression on the public mind, and rarely fails to give rise to the invention of some new *fire-escape*; yet still we do not find any of these adopted so generally, as to remedy the evil. This may be owing, either to the inefficiency of the contrivances, or to the neglect of the magistracy to provide a proper number.

Fire-escapes not generally adopted.

Two species.

Machines for this purpose are of two different kinds, first, those which are intended to operate from the street below, and can be quickly erected to communicate with any window: Of this kind are ladders, and poles with pullies and ropes to draw up a basket, also a variety of curious and complicated machines or elevators; of course all such machines must be kept at the public expence, for the service of a whole parish, in the same manner as fire-engines, and must be made to remove very readily. The other kinds of fire-escapes are those which can be fixed to a window, and allow the unfortunate sufferer to descend safely into the street. Machines of this kind are intended to be kept in the bed-rooms of the house; and each house must be provided with one at least, to render the contrivance generally effective. Both kinds have their inconveniences; the first, from the difficulty of conveying them with dispatch from the places where they are deposited, to the situation where they are to act: This objection they have in common with fire-engines; but it is here more sensibly felt, because the fire-escapes which have been made, are but very few in number; nor can it indeed be expected that they will be generally provided, unless parishes were obliged by law to keep fire-escapes as well as fire-engines, and in this case the same regulations might be applied to both.

Moveable.

Fixed.

Fire-ladders.

At present in London, and some other large towns, fire-ladders are kept in every church-yard, for the service of any fire which may happen within a reasonable distance. This regulation is in a great measure rendered useless from inattention in the keeping of the keys of the locks, which are applied to prevent the ladders from being improperly removed. A key is generally deposited with each churchwarden, and one with the clerk of the parish; but the nearest watchman, or every patrole, should be provided with a key, that no delay may occur in rendering assistance. A melancholy instance of the necessity of this regulation occurred in London a few years ago, when three persons were burned, at the windows of a house, from which they had a sight of the fire-ladders; but the churchwarden, who lived at some distance, could not be awakened to procure the key until too late.

Ladder with wheels.

We have seen, some years ago, a long ladder, provided with a pair of wheels, which were fitted upon an axletree attached to the lower end of the ladder, within about three feet of the extremity. A weight was attached to the end of the ladder, to counterbalance so much of its weight, that one man, by treading upon the lower end, could elevate it upon the axle of the wheels; but when raised to about an angle of 65 degrees, the end of the ladder touched the ground, and therefore if it was elevated more than that, the wheels were born off the ground, and left the ladder to support itself independent of them.

This simple addition of wheels to a fire-ladder is of great advantage, not less in conveying it to the place, than in rearing it, which is always a work of much labour, and among those who are unused to it, of no small difficulty. With the wheels, nothing is more easy, the weight being balanced, and three or four men can draw it along the streets as quick as they can run, whereas, at the utmost, they can only walk quickly when bearing a long ladder on their shoulders, from the difficulty of stepping exactly equal paces. The length of the ladder should be from 25 to 30 feet, according to the kinds of houses in the neighbourhood where it is to be kept. This simple contrivance appears to us of more utility than any other fire-escape which we have seen proposed. Amidst the number of ingenious, but complicated machines, which have been rewarded and published by different learned societies, we have no doubt that a sufficient number of fire-ladders, thus mounted, and kept as the ladders now are in the church-yards, would be the most effective provision that could be made against accidents of this nature. As we are not altogether without hopes of seeing this arrangement adopted, we shall add a few words on the best and most economical method of constructing such machine; because when great numbers are required, the expence is an object of attention. The two spars of the ladder may be formed out of a clean piece of fir, such as is used for masts and oars. Each should be about five inches by three at the lower end, and regularly tapering up to three by two at the other; now, as the spars are much weakened by the holes bored through them, for the rounds or steps, we propose to use another method, and at the same time to truss the spars, to render them more strong. For this purpose, each is to be divided from the middle to within three or four feet of each of its ends, by a saw-kerf, made in the direc-

Its utility.

Cons- tion.

tion of the length of the piece; a wedge is then to be driven into the cleft, to open it in the middle, to a width of eight inches, and small blocks of wood are to be fitted into the opening, which will be eight inches wide in the middle, and gradually diminishing to nothing towards the ends, where the spars has not been divided. One of these blocks should be placed at the proper place for every round or step which is intended to be made in the ladder; and the ends of the rounds are to be fixed in these pieces, except towards the ends, where the cleft being narrow, the ends of the rounds themselves being made square, may be fitted in the opening instead of the blocks. The blocks and the ends of the rounds, where they touch the insides of the opening, should be let into the wood the eighth of an inch to prevent them from moving. The whole is to be bound fast by slight iron hoops, driven on from the ends, and particularly at the solid ends, to prevent the opening splitting farther than was intended. By this method a ladder is formed of very great strength, without increasing the weight. It is the same mode of strengthening spars, which has been proposed by Mr G. Smart, for temporary yards for ships. The wheels of the ladder should be of the largest size used for phaetons, which is about five feet eight inches, with twelve spokes. It is an advantage to have the wheels as large as possible, because a smaller balance weight will then be sufficient. The weight should be of cast iron, and fixed across between the two spars, in the manner of a cross-rail at the extreme end, so that it will be as far as possible removed from the axle.

ope and ske.

From a machine of this kind we may expect all that can be done by a simple ladder; but by the addition of a rope, pulley, and basket, it may be made capable of lowering goods, or helpless and infirm persons, and children. The pulley should be suspended from a round, at about three feet from the upper end, which round must in that case be made of iron. The rope should be rather more than twice as long as the ladder, and of a sufficient strength to bear four hundred weight. The basket should be very shallow, and surrounded by a strong sack-cloth, so as to be rather a sack with a basket bottom, and a hoop in the mouth to keep it extended; this will fold, and lie close to the underside of the ladder, where it should always be lashed by the spare end of the rope, the remainder being extended between the pulley and the lower end of the ladder, so as to be in no danger of entanglement. In this way, the operation of the ladder will not be at all impeded, and the rope will always be ready for action, by untying the end of the rope, and thus releasing the basket. This rope will be extremely useful to haul up the leathern pipe or hose of an engine; and the fireman ascending the ladder, will be able to direct the jet to the greatest effect into the windows of the first, second, or third floor, the rope sustaining the weight of the pipe, which would otherwise be too great for one man to hold when upon the ladder.

scape
pole,
nd
b

A machine is described in the Annual Register, some years ago, with a rope and basket; but a pole from 36 to 46 feet in length was used in place of the ladder. This pole had the pulley fitted into a mortise, at three feet from the upper end; it had also at each end an iron cross bar fixed, to project perpendicularly on each side, one to bear against the wall, and the other upon the ground, and form a foot to keep the pole steady. To assist in raising the pole, two smaller poles or handles were connected with the great one, at two or three feet above its middle, by eyes which admitted a motion in every direction. Several persons could apply their force very advantageously at the ends of these poles, to elevate the great one; and when it was raised, the poles formed legs like a tripod, to strengthen the great pole, and prevent it from bending in the middle. It is stated that a pole of this sort was elevated, and two or three persons lowered from the upper windows of a house, into the street, in the space of 35 seconds, or rather more than half a minute. Still, as the pole was five inches diameter at the base, and three at the upper end, it could not, with the addition of the side poles and basket, be rendered very portable, and, from its length, it would be troublesome to turn the angles of narrow streets, and therefore we prefer the ladder with wheels, which is extremely easy of transportation, and which, from the facility of raising it by the balance weight, can be elevated to turn a narrow corner. If it is trussed, as we have described, it will have as much strength as the pole, when propped in the middle by the two short ones.

Fire-escape by Mr Davis.

We think it is scarcely necessary to describe any other machines, except very briefly. The principle of several of them is to have two, three, or four ladders, fitted one upon the other, or rather one within the other, and provided with a tackle by which they can be elevated to the height of the window. The most complete of this kind is described by the Society of Arts, in their Transactions, vol. xxviii. The base of the machine is a four-wheeled carriage, with a pair of shafts for a horse to draw it. The lowest of the three ladders is fitted in the carriage by a bolt, on which it can be inclined sidewise at pleasure, to reach the window, and retained at any elevation by a frame with screws. The three ladders are made to fit one within another, and provided with iron clamps to confine them together. In the back of the frame, beneath the ladder, is a windlass, which receives the ropes for sliding up the ladders. These consist of two parallel ropes, proceeding from the windlass, and passing over two pullies, fixed at the upper end of the principal or lowest ladder, and the ends are made fast to the bottom of the second ladder. Therefore, by turning the windlass, the ropes are drawn, and the second ladder is elevated upon the first. The third ladder is likewise provided with two parallel ropes, passing over pullies, at the top of the second ladder, and attached to the bottom of the third; but the opposite ends of these ropes, instead of being carried down to the windlass, are made fast to any part of the lower ladder: in this way they have the same effect to raise up the third upon the second, when that is elevated upon the first by means of the windlass. The remainder of the apparatus is a windlass, in front of the machine, with two ropes passing over pullies at the top of the highest ladder, and suspending a box or chest, in which the goods are to be lowered down. The upper end of the ladder is provided with a bent iron bar, to lean against the window, and thus retain the top of the ladder at such a distance from the wall, as to admit the box to ascend and descend clear of it.

Its tackle.

Machine with a lever.

We have seen another machine on a different principle: its carriage supported an upright post, which was fitted to turn round in the manner of an axis. The top of it formed the fulcrum of a very long lever, which, at one end supported the basket, and at the other a considerable balance-weight. The height of the vertical pillar was such as to raise up the centre of the lever to about half the height from which the descent was intended to be made. The lever then required to be sufficiently long to reach to the window, when elevated at an angle, and also to the ground when its end was depressed. The lever had an arch or toothed sector attached to it, beneath the centre, and this was worked by a pinion with wheel-work, by which two men, turning a handle and standing upon the platform, could command the elevation of the lever, and the basket attached to it. By raising the end to the height of the window, and turning the vertical axis round, they could make the end of the lever enter the window, and the persons having put themselves into the basket, the end was to be a little raised, then by turning the vertical axis the basket was brought over the street, and lowered safely down by the men at the handle. The basket could again be elevated, and another person brought down with equal ease. The only objection to this machine is, that the lever would require to be of such a great length, and having no support at its ends, would require a cumbersome framing, to render it sufficiently strong. A simple and effective mode of trussing would be Mr Smart's plan of dividing the rod lengthwise by a saw kerf, and introducing blocks to swell the beam in the middle, and give it stiffness, as we have before described of the ladder. A boom and stays, to act like the shrouds of a ship, would give it great strength without any increase of weight.

Mr Robert's machines.

The Society of Arts have published, in their thirty-first volume of Transactions, descriptions of two fire escapes or elevators. They consist of a number of bars jointed together in pairs, by a pin in the middle of each like a pair of shears. To the upper ends of each of these the lower ends of a second pair are jointed, and to these a third pair, and so on of five pairs. The whole assemblage will therefore consist of similar parallelograms placed one upon the other. Now, by forcing the lowest ends of the levers to approach towards each other, the parallelograms are caused to elongate in the vertical direction, and raise up a platform to the required height. The machine, when elevated, forms a lofty tower, within which a regular range of ladders are placed in the manner of a staircase. The contrivance is ingenious, but by no means applicable to the purpose, from its complexity. One of these machines is composed of 24 levers, and 8 ladders, besides the smaller parts. The other machine has 40 levers and 8 ladders within it.

Rope-ladder.

Of the other kind of fire-escapes, which are to be fixed from the window, the most simple is a rope-ladder, with wooden rails for the steps; but, unless a post with a hook is fixed below in the street, to attach the lower end of the ladder to it, and strain the ropes tight, it is extremely difficult to descend.

Sling fire-escapes.

Another species is called the sling fire-escape. This consists of a rope, to which the person fastens himself by a girdle, and throwing himself out of a window, is lowered slowly down, the rope having some contrivance to cause a friction or resistance, which will prevent any acceleration in the motion.

Mr Forster's.

The simplest of these has a long rope provided with two straps or belts, one to buckle round the waist of the person who is to descend, and the other to pass under him, so that he sits as in a swing when suspended by the rope, which is rather more than twice as long as the height of the window from the ground. The rope is made to pass through a double eye or iron ring, suspended from a hook fixed over the window; then the other end of the rope is brought down to a piece of wood called the regulator, which is attached to the girdle strap, that the person wears. This piece of wood has three holes in it, and two deep notches, into which the rope is woven, and will thereby have so much friction in passing, as to make it slip through regularly, and quite at the command of the descending person who is to hold the rope in his hand; and by letting it slip more or less, he can easily regulate his descent. This plan was proposed by Mr Forster.

Another machine, invented by Mr Maseres, had the same arrangement, except that the rope, instead of passing through the iron ring or eye above mentioned, is wrapped three or four times round a small cylinder, made with a proper spiral groove, and fixed in an iron shank like the strap of a pulley, but rivetted fast, so that it cannot turn round. By means of a hook in this shank, the cylinder can be suspended from the hook which is fixed over the window. The groove in this cylinder causes so much friction in the passage of the rope, that the person who is suspended has an equal command as in the other method; but, without passing the rope through the notches in the piece of wood, he can command it when he holds the other end of the rope in his hand, and lets it slip more or less at pleasure.

Another machine, which was exhibited in London, was contained beneath a stool, to stand by the bed-side. On an alarm, this stool could be instantly fixed to the window, by hooking two of its legs over the sill of the window, in the same manner as the boards used by a painter to support himself whilst he paints the outside of a window. Beneath the stool was an axle, upon which the rope was wrapped two or three times; a small wheel was fixed on the end of the axle, and a gripe inclosed this, with a spring to cause sufficient friction to retard the excessive motion of the wheel and axle. The spring was regulated by a screw, to bear upon the wheel with any required force, in proportion to the weight of the person who was to descend. A strap was placed at each end of the rope, so that when one had descended, the girdle-straps at the opposite end of the rope would be ready for another person to come down.

Mr Salmon has contrived another machine, which appears superior to any of these: It is a large pulley, placed in an iron strap, by which it can be hung up over the window. It is made with a deep angular groove, so that the rope which passes over it cannot slip; and, to render this more secure, the groove has several sharp pins fixed in it: the rope has a girdle-strap at one end, and a sufficient counterweight at the other, to make the rope apply so firmly to the pulley that it cannot slip, and also to draw up the strap the moment the person who has descended has ungirded it. The pulley has a toothed wheel fixed against it, which acts in the pallets of an anchor-escapement, fixed on an axis, placed in the same iron frame or sling, above the axis of the pulley. A short pendulum, with a heavy bob, is fixed on the end of the arbor of the anchor or pallets. By this contrivance the pulley is regulated, as the escapement will not suffer it to move with any more than the intended velocity; and if the pallets of the anchor are formed of a proper shape, as will be described in the article Horology, it will make very little difference if the weight which descends is a small or a great one. The escapement-wheel is attached to the pulley by a ratchet-wheel and click, which admits the counterweight to draw up the strap-girdle without acting on the escapement, as soon as the person who has descended quits it; and the machine is then ready to let down another person.

Another fire-escape, to affix to a window, is composed of a strong sail-cloth, sewed up, to form a long bag or sack, which is open at one end, and of such

An escape for infirm persons.

length that it will reach from the window to the ground when inclined in an angle of 45 degrees. The upper end of the sack is extended by a hoop sewed into it, and has a cluster of small cords, very similar to the suspension of a hammock, which proceed from different parts of the hoop, and all join in two rings, by means of which it can easily be suspended from two hooks, at the sides of the window-frame. The lower end of the sack is sewed up, but it has an opening in the side, sufficient to let out a man; and the borders of this opening must be well hemmed with a cord to make it strong. Two cords are also made fast to the end of the sack, by means of which the lower part can be lashed to any post or other fixture at the opposite side of the street, to stretch and retain the sack in the inclined position. The use of this contrivance is evident, as it forms a practicable inclined plane, in which any person can safely slide down to the bottom, and be taken out at the side-opening. It has the advantage of all the others, because women, children, or infirm persons, however distracted by fear, can be put out of the window into the hoop, and will arrive safely at the bottom; whereas the other contrivances with ropes, though equally safe in reality, have so much more appearance of danger, that there would be some difficulty in such cases. It is scarcely necessary to add, that the sack must be made very narrow, so that a person can only pass easily through it, and they will then be able to regulate their descent, by extending their arms and legs, although the width of the street should require the inclination to be greater than 45 degrees. In case there is not any sufficient fixture to lash the lower end of the sack to, it must be held by two or three people, who, indeed, if they are careful, will do it more effectually than a fixture, by raising the end when a person comes down towards the lower end, so as to check the descent. For this purpose, two or three rope handles are provided on each side, at the lower end, for the bystanders to hold; and these are equally useful when the end is lashed fast. It is plain, that goods of small bulk can be sent down by the same means; but, to prevent any accident of stopping up the sack, the hoop at top is made smaller than any other part.

mb's ladder elevator.

A new fire-ladder, and an elevator for supporting and raising the leather pipe of a fire-engine, have been invented and constructed by Mr William Lamb, builder in Leith. The fire-ladder is nearly upon the same principle as that of Mr Davis, which we have already described. It consists of three ladders, one within another, the two innermost being elevated upon the outermost by a rope and pulley, and if necessary by the aid of a windlass. The elevator consists of two square tubes and a square beam, the first square tube containing the second, and the second containing the square beam. All these are supported in a vertical position by four legs, the lower extremity of the first or outer square tube resting on the ground. By means of a pulley moved by a windlass, the second square tube can be elevated upon the first, and the square beam upon the second square tube, to the height required. About four or five feet below the top of the square beam is fixed a platform, upon which the fireman stands while he is raised to the necessary height for the purpose of directing the pipe of the engine, the end of which is fixed upon an universal joint on the top of the beam, so that the fireman has no weight to support, but is solely employed in directing the pipe to the proper part of the building. We are glad to learn that the magistrates of Leith have ordered both these ingenious machines to be constructed for the use of the town, and we trust every other town in Scotland will follow their example. The expence of the ladder when about 42 feet long will not exceed £5; that of the elevator £13 or £14. The elevator may be applied to many other purposes; and Mr Lamb proposes also to construct it, so that any person may raise himself.

An account of a fire ladder which supports itself, will be found in the *Acta Petropolitana*, vol. i. p. 1. See also Leopold's *Theatrum Machinarum*, tab. 54, 57; Emerson's *Mechanics*, 228; Varcourt, *Mem. Acad. Par.* 1761, Hist. 158; Collins, *American Transactions*, tom. iv. or *Repertory of Arts*, vol. xv. p. 25; Audibert, *Mem. de Institut.* tom. iv. or *Repertory*, vol. i. p. 439. (J. F.)

FIREWORKS. See PYROTECHNY.

FIRST, in Music, sometimes implies the first, and sometimes the second chromatic degree of the scale: thus, FIRST *Major* (I) has the ratio $\frac{128}{135}$, $=47\Sigma+f+4m$, called also the sharp minor first, and is the SEMITONE *Medius* (S), which see.

FIRST *Minor* (1), has the ratio $\frac{1}{1}$, and the length of string 1, but is without magnitude, and consequently its logarithms and notations of all the different kinds are 0: it is called the *Unison*, Equisonant Prime, Homophony, Istesso; and by Mr Overend, in his manuscripts, it is called *Radix*, and marked with an ℞, having a dash across its last stroke. (ɛ)

FISH. See ICHTHYOLOGY.

FISHERIES.

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Fisheries. Introduction.

IT has been admitted by our own, as well as by foreign writers, that Britain, and her dependent islands, are most advantageously situated for the various and valuable fisheries, with which their lakes, rivers, and seas abound.

At an early period of our history, the fisheries not only became an object of serious attention to individuals, but attracted the particular notice of government, on account of the important objects to which they might be made subservient.

Among the many kinds of food which are given for the subsistence of man, fish is one of the most wholesome and abundant; and such is its powerful influence on population, that it is generally allowed that the empire of China owes the immense number of its inhabitants to the astonishing quantities of fish with which they are supplied. Britain, however, we apprehend, may boast of a greater and choicer variety than even China; for, out of about four hundred species, as described by Linnæus, we can enumerate nearly one hundred and fifty to be inhabitants of our own waters, and almost all these are esculent.

Those chiefly distinguished in our established fisheries are cod and herring, with their numerous congeners, mackerel and salmon. These, when pickled or dried, find at all times a ready vent in the European continent, or West India islands. For the other kinds which we have not here specified, there is always a demand, either as fresh, green, or cured fish, for home consumption.

The figure and vast extent of our indented coasts, afford many advantages for procuring that fine variety of fish with which our seas are stored; for, from whatever point the wind blows, we always have some tracts out of the reach of the weather, where our fisheries can be carried on, whether for inland use or exportation. We also have, in every direction, ports, harbours, and bays, to which vessels during heavy gales can easily and speedily run; and our shores furnish us with all kinds of natural bait for fish that are taken with the line and hook, as lampreys, razor shell fish, cockles, limpets, whelks, &c. We have a full command of materials for ship-building, and for making fishing tackle of every description. By proper care and management, our salt might equal, if not excel, the best salt formerly used and prepared by the Dutch in the curing of their fish, and to which their superiority in point of flavour was we believe generally, and we think justly, ascribed. The inhabitants of the British isles not only possess greater capitals, but are noted too for intelligence, and for a spirit of enterprise far above those of other nations.

Notwithstanding these advantages, our fisheries have not only never been prosecuted to their utmost extent; but, in spite of the many bounties and privileges attached to them from time to time, they have been on the decline for several years past.*

We cannot easily ascertain the causes that have led to this failure; but it is a matter of severe disappointment, that this branch of our commerce has not been managed so prosperously as our flattering situation gave us reason to expect. In order to remedy this evil, that public spirited body, the *Highland Society of Scotland,* after great exertion and careful investigation, discovered and pointed out many of the errors and abuses which had long prevailed in that valuable branch, *the white herring fishery*; and by means of their reports, a bill was brought into Parliament, and enacted. This act is dated the 25th of June 1808, and the provisions of it took place from the 1st of June 1809, and were to continue in force until the 1st of June 1813, and from thence to the end of the then next session of Parliament, (1814). Some amendments were at that time proposed, and with these we suppose the same act either has or will be renewed. It is a spirited and fair experiment, and we hope will afford a proof of the utility and many advantages that must accrue to the state from a persevering prosecution of all the branches of *the deep sea fishing*. Yet, at the same time, we must remark, that this act is not without its imperfections; and it is to be regretted that it did not embrace regulations for some of our other fisheries, which so palpably require parliamentary interference, such as conservancies for our salmon rivers. Had the commissioners in that act been appointed as a court of conservancy, with a power, according to local situation, to constitute district courts under them, it might have saved that fishery from an unimportance to which it is fast verging. The use of stake nets,† and the wanton and prodigious destruction of the fry in various parts of the country, have been very injurious to this fishery. It would have been well, too, had it held out great and particular encouragement for a junction of the cod with the deep sea herring fishery. This might have lengthened the time of fishing to the greatest part of the year, which would have kept the busses, ill adapted for any other trade, almost in constant employment; and, of course, induced the owners to procure more apprentices, to whom, as well as to the masters, upon the expiration of their indentures, liberal premiums might have been granted. The accomplishment of such a plan would have formed a nursery of the most hardy and intrepid seamen. The last observation that we shall here make on this act, is, that the bounty which it offers is too small, particularly if it is considered, that it was augmented from thirty to fifty shillings so far back as the year 1757. Had it been five pounds in place of three pounds per ton, the increase would have kept pace with the depreciation of money and the advanced prices of materials.

It may be necessary, also, in this place, to mention the objections made by adventurers in that fishery, to the hardships (as they alleged) attending the former bounties, leaving it to our readers to determine if "*The Act for the further Encouragement and better Regulation of the British White Herring Fishery*, 1808," applies remedies to all these complaints; and whether they were then, or are yet, well or ill-founded. They are as follow: "That the fishing vessel must go to a certain port; the equipage must pass in review before the officers of the customs; the ship must complete her cargo, or remain three months at sea to do it:—so that, if in the first week she procured nine-tenths of it, she would be obliged to keep the sea for the other tenth. The ship can take no instruments but those proper for the fishery to which the premium is applied; the cargo cannot be discharged but in a certain port:—there are general formalities to be observed with respect to the salt which she carries out and brings home:—the owners are exposed to vexations from custom-house officers, and to law-suits which they are obliged to carry on in courts of justice far from their residence." Such have been in part the causes assigned for the decline of this fishery. Many, too, are the prejudices formed against granting bounties to the busses employed in the deep sea herring fishery. It has been, and is still contended, that the support given to them is too lavish, and that they ought to be left to stand or fall according to their own weight.

We have seen various schemes, and various proposals, for untried and more vigorous efforts in the prosecution of our fisheries; we applaud every suggestion that can be offered for that purpose, although we cannot approve of any we have yet perused. A national fishery, on a grand scale, has been recommended; and the following are the outlines, as given by an anonymous author.‡

"1. A grand national corporation organised under the immediate protection and superintendance of parliament. 2. A capital stock of ———————— to be raised in shares by the sea-port towns and corporations, proportioned to the advantages of locality, and amount of their trade and tonnage; an annual dividend of five per cent. guaranteed on the capital. 3. Conveniences

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* We must, however, in these general observations, except the whale fishery, which has of late been carried on most successfully, and almost exclusively, by this country.

† This destructive practice is in some degree now removed; for the Court of Session gave a decision in 1812, declaring stake nets, whether fixed or floating, illegal, and prohibited all the proprietors on the river Tay from using them. An appeal to the House of Lords, in consequence of this judgment, was however lodged, and lies there yet undecided.

‡ *Plan of National Improvement, &c.* 1803.

Introduction.

for shipping, store-houses, shreds, &c. constructed in places contiguous to the best fishing grounds. 4. A free use of salt by the managers, without any interference of the revenue officers. 5. The fish taken and cured, to be exempt from all duties whatever; on the other hand, no bounties to be given. 6. Fishermen disabled by accident, age, or infirmity, and the widows and children of fishermen, to be provided for. 7. The corporation to be authorised to propose rules for the regulation and discipline of the fishery."

This plan, we apprehend, is too complicated to succeed, too like a monopoly, and by far too general to be adopted. From distinct fisheries carried on, and vessels fitted out by individuals, and private companies, more spirited exertions may be expected than from this proposed corporation, especially if they are favoured with an enlargement of the bounties, and an exemption from all duties connected with the fisheries.

We have observed, with much pleasure, many useful hints and resolutions in "The First and Second Reports of the Committee of the Fish Association for the Benefit of the Community, respecting the Measures to be adopted for the Supply of the Metropolis and its Neighbourhood, 1813." The first object they have in view, is, a facility of bringing fish to the metropolis, whether by land-carriage or otherwise; to break the combination of the fishmonger's company; to crush the monopolizing and exclusive trade of Billingsgate; and to establish more central and general fish-markets in the cities of London and Westminster. By a completion of this system, an immense consumption of fish would undoubtedly take place; the middling and poorer set of people might enjoy the luxury of a fish diet, and consequently this great mart being fully and cheaply supplied, would in all probability increase the demand and number of fish, not only in the metropolis, but throughout all the great towns in the kingdom, which of course would follow its example.

SECT. I. *On the Cod Fishery.*

fishery.

The cod-fish, *Gadus morhua* of Linnæus, the *Asellus maximus* of some authors, and the *Asellus varius vel striatus* of Schonovelde and Jonstone, is of the order *Jugulares*, and the most considerable of that numerous and valuable genus *Gadus*; a genus which comprehends no less than 18 species, all esculent, and natives of the British seas.†

The cod measures generally from 26 to 36 inches, although some have been taken above five feet long. The upper maxilla is longest, lateral line white, the colour on the back and sides of a dusky olive, with yellow spots intermixed; the scales are proportionally small, and adhere firmly to the skin; the eyes large and heavy, covered with a loose transparent membrane; the barb, about the length of a finger, depends from the angle of the lower jaw; it has several rows of teeth, and some of them moveable, as in the pike; it has three fins on the back, two at the gills, two at the breast, two at the anus, and the tail even.

The cod is a gregarious, and a very voracious fish, devouring not only all kinds that it can swallow, but even its own species. Indeed, the immense variety of animals with which it is often found gorged, is truly surprising. They are very prolific, each spawner producing many millions of eggs annually. Lewenhoek computed no less than 9,384,000 ova in a single cod; and, upon the 23d of December, Mr Hanmer 3,686,760 in one of a middling size, which weighed 12,540 grains. The flesh is white, firm, comes off in flakes, exceedingly good, and held in higher estimation in every part of the world, except by the inhabitants of Edinburgh, than that of its congener the haddock, (*Gadus æglefinus*). Various are the names given to it, both when fresh or pickled,—cod, keeling, cabillow or cabillaud, green fish, Iceland or mud-fish, Aberdeen fish, North Sea cod, stockfish, barrelled cod, poor John, and, throughout Scotland, when dried, *hard fish*. Their young, and those under 20 inches, are called codlings.

Cod fishery.

They generally spawn with us from February until the middle of April, and sooner recover than any other fish from their shotten state; for, in a few weeks, after having shed their roes and milts, they appear plump, well coloured, and full about the tail. This species is infested with a variety of vermes, as the *Gordius marinus* of Linnæus, the *Echinorhynchus*, the *Cucullanus marinus*, the *Fasciola piscium*, the *Tænia rugosa*, all of which are to be found at times in their intestines, and the *Lernea asellina* in their gills and pectoral fins. There is no fish of more general use, and more suitable to all palates, than the cod; and it is in plenty, and fit for eating, in some or other of the waters which encompass our islands, at almost every time of the year. It is to be found on both sides of the northern hemisphere. A cold climate seems to be rather its choice, as the region which it prefers in Europe is from 50 to 65 latitude; that is, from near the Scilly islands to Iceland; and in America, from about 41 to 58 latitude; that is, from about Rhode island to the shores of the Eskimaux.

The cod fishery, in which we include, of the same genus, the ling (*Gadus molva*), and tusk or torsk (*Gadus brosme*), forms the most extensive fishery of which Britain can boast; for we have not only the range of our own islands in Europe, but the vast banks of Newfoundland and the fishing grounds along the shores of Nova Scotia, St John's, Cape Breton, and in the Gulf of St Lawrence: all of them seas noted for the quantity of this valuable fish which they afford.

It was found expedient, by the late act of parliament, to give what was thought a liberal encouragement to decked vessels of considerable burden, in the prosecution of the deep sea herring fishery; but it certainly must be allowed to be fully as necessary and suitable to that of the cod. Herrings lie commonly nearer the shore; and as they are not so often found in the strong rapid currents as the cod, the use of small open boats is improper and injudicious for that fishery, unless it be with the view only of affording a temporary supply of fresh fish for the inhabitants of the coast.

The fisheries, indeed, are carried on by the natives of Scotland (with a few exceptions) in a very awkward and slovenly manner. The common method of taking cod, ling, haddock, &c. is to go out only a few miles from the shores of their fishing-towns, with a crew consisting of four or five hands, sometimes one or two of them boys, in an unprovided, undecked boat, carrying with them many tires of long lines, which they oftener set than fish with. These they drop on the grounds where they think the fish lie; and, when the weather is in the smallest degree boisterous, they leave them attached to neat's bladders all night, and indeed frequently for many successive days and nights; that is, until it becomes so moderate as to suit their choice and conveniency to return. They then draw up their lines, find the baited hooks stuck in the stomachs of the fish, or the fish exhausted by long struggling, or dead, or eaten into the entrails by vermin. In this condition are what they call *fresh* cod, *fresh* turbot, and other kinds of fish caught by the line and hook, offered to sale in our markets. Let us now observe the modes that the English and Dutch practise in the management of their lines, both for what fish they are to sell fresh, and also for such as they mean to cure. In spring and summer they use short, and in winter long lines, on account of the cod keeping nearer the bottom in that season, and which (according to the fisherman's phraseology) they always *keep bobbing*, that is playing backwards and forwards by little and tremulous jerks of the hand and arm, by which means, as in angling, the line and hook are in continual motion; and, feeling the fish the moment he bites, they instantly haul him up. They are therefore all caught by the lip or mouth, which saves a great deal of time, as the fisherman is immediately enabled to renew the bait, not having to extricate the hook either from the gorge or stomach; besides, they are all taken alive, without being torn or mangled, a consideration of no small importance.

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† Berkenhout's *Synopsis of the Natural History of Great Britain and Ireland.*

In this manner, on the cold and uncomfortable banks of Newfoundland, each expert fisherman, although he can take but one at a time, will catch from two to three hundred of their heavy fish in a day. This is the most valuable cod-fishery in the world, and may be now said to belong entirely to Great Britain. The island is situated between Lat. 46° 45′ and 51° 40′ North, and between Long. 52° 31′ and 59° 40′ West. The grand bank is about 70 miles from it, and is 400 miles in length, and 200 in breadth, not including the Jaquet and Green Banks, &c.: the greatest and best part of it lies to the south and east of the island. The depth of water, according to Governor Pownall's chart, varies from 24 to 60 fathoms. The immense shoals of cod, with the variety of other fish which inhabit the grand and lesser banks, excite astonishment.

In these regions an unceasing warfare is carried on, fish against fish, the larger devouring the smaller, not even sparing their own species. The cod is seemingly the most powerful, being generally the largest and most voracious. The greatest number, as well as the fattest and bulkiest fish, are to be found where the water is rough, with a sandy ground; on the contrary, they are lean and scarce where the water is still, upon an oozy bottom; and the depth to which they seem mostly attached, is from 30 to 40 fathoms,—particulars which fishermen and seamen soon learn, by their being most successful in these soundings.

This fishery gives freight to nearly 300 vessels, from one to two hundred tons burden each. They are mostly fitted out from Guernsey, Jersey, Ireland, and ports in the English Channel, as Poole, Dartmouth, &c.; they carry about 35,000 fish each, upon an average; their chief markets are Spain, Portugal, Italy, and the Levant; for the other parts of Europe are commonly provided with those taken in the British seas, the Dogger, Wale, or Wese-banks, and other parts of the North Sea. Besides these large vessels, there are at least 2000 small-decked craft, or shallops, from 12 to 20 tons burden, rigged like the luggers in England employed in the fisheries along the shores of Newfoundland, Nova Scotia, and the islands of Cape Breton, a great part of whose hands is taken up on land, in erecting stages, and in curing and drying their fish. The principal scene for this employment is on the coast of Placentia Bay, which opens between Chapeau-Rouge Point westward, and Cape St Mary on the east. When a vessel has taken her station on this or any other bay, she is immediately unrigged, leaving only the shrouds to sustain the masts.

The livers of the whole genus *Gadus*, yield a well-flavoured oil. The zounds and tongues of the cod are also salted and barrelled, and are much esteemed as dainties, in the islands and continent of America. Mr Morse, the American geographer, says, (we, however, suspect the account is somewhat exaggerated,) "Great Britain, and the United States, at the lowest computation, annually employ 3000 sail of small craft in this fishery; on board of which, and on shore to cure and pack the fish, are upwards of 100,000 hands." In our article England, Vol. IX. p. 14. we have already given an account of the quantity of fish caught, and of the number of vessels, &c. employed in the Newfoundland fishery in different years.

Of late years, the English have sent a number of welled smacks, stoutly manned, to the island of Orkney, where they fish in the deep water, and strong currents, along the banks of the Pentland Frith, Cape Wrath, and the adjacent headlands. In the prosecution of this fishery, they have been extremely successful; and although at such a distance, have afforded a great and excellent supply of fresh cod, and also of new cured fish, for the market of the metropolis.

The owners of these welled smacks are Saunders, Selby, Cresswell, and a few other fishmongers of Billingsgate, who employ about 40 of these vessels. They rendezvous in Long Hope, Orkney, from whence three or four run weekly for the Thames. When they arrive at Queenborough, they unload, and then send their fish in small boats up to London.

Sect. II. *On the Herring Fishery.*

On the herring fishery.

The name *herring* is derived from the German word *heer*, signifying an army, as expressive of the numbers in the great shoal, which annually appear upon the northern coasts.

Our common herring is from 7 to 12 inches long; a fine silvery colour shines upon the belly and sides, the back somewhat greenish; the scales are large for the size of the fish, and come easily and regularly off; the lines are small, and not easily perceived; the under jaw is a little longer than the upper; the dorsal fin consists of seventeen, the ventral fins of nine, the pectoral seventeen, the anal fourteen, and the tail forked with eighteen rays. He dies instantly when taken out of the water.

This is the *Clupea harengus* of Linnæus, Rondeletius, Gesner, Willoughby, and Ray. The *Halec* of the Romans, we suspect, was not a herring, but rather a preparation from some other fish, as the *Botargo*, the precious *Garum*, or something resembling our modern essences, for fish sauce.

The *Shad*, or as called by some authors, the mother of herrings, (*Clupea alosa*,) is the only one of the genus that betakes itself to fresh waters, and in Britain is only to be found in the Thames and Severn, where it is supposed to ascend, for the sole purpose of spawning.

In the months of November, December, January and February, herrings generally deposit their ova on the *Fucus palmatus*, dilisk, (called in Scotland dulse,) or *Ulva*, laver, and other sea-plants, and sometimes on gravel. They are there impregnated by the milter, and become animated in April, or beginning of May. The herring is a prolific fish; Mr Harmer, after examining one of a middle size, found the weight of the spawn to be 480 grains, and the number of eggs 36,960.

As the heaviest salmon are found in our large rivers, so are the largest herring in our deep waters; and if we minutely observe, we shall find each coast and river to produce a fish, although bearing the same generic and specific characters, different in taste, size, and appearance. It is well known in the salmon, and no stronger instance of this fact can be given, than that of the shad of the Severn and the Thames; the flesh of the first is fat, rich, and delicious, brings a price equal to salmon in the market, and appears in April and May; that of the last is lean, coarse, and insipid, and does not enter the Thames till July. A distinction equally striking is to be noticed in our west and east country herrings, although all detachments from the same great original army or shoal.

The varieties of our herrings may be reduced to two or three sizes. In the bays and lochs of our Western Highlands, they are not only larger, but superior in taste and flavour to all others: from 650 to 800 fill a barrel. Those of the Friths of Forth and Tay require about 1000 to 1100. High up the Murray Frith, it takes about 1500 to the barrel.

It has been a matter of curious inquiry, how far to the northward these herrings proceed, after leaving our shores. We imagine that Mr Pennant and some other naturalists have mistaken the winter residence of the herrings, who say, "they return to their parental haunts beneath the ice, to repair the vast destruction of their race, during summer, by men, fowl, and fish." For what purpose they should have received an instinct to retire to the Polar seas, is to us incomprehensible. Surely the icy regions are unfavourable both to life and vegetation, and consequently for animal food. The salmon, the shad, the smelt, are never found at sea, yet it is never said that they depart to any great distance from our shores. The most reasonable conjecture we can form, is, that the herring, like our other migratory fishes, take to the deepest parts of the ocean. None of our voyagers nor whalers ever pretended to have seen them to the northward (if even so far) of the 67th degree of latitude.

The Dutch, who formerly fished but a little way from Shetland, would have undoubtedly begun their fishing sooner than the first of July, by meeting on their passage the herring shoals farther to the north, if such an immense body issued from within the arctic circle. So far, indeed, from their betaking themselves to such cold quarters, they often remain here during the winter; and to-day (19th March,) we have examined some, which were taken in the Forth in the morning, containing both milts and roes. We acknowledge, that their continuing here so long, and being so late in spawning, are circumstances very unusual.

In migrating from the deep seas to our shores, the herring seems to be prompted by a similar instinct to that of the shad and salmon, of casting its spawn in its native waters; however, they are more desultory in their movements than either of these fishes.

From the Friths of Forth and Tay, about the year 1788, both haddocks and herrings took their departure, and did not return for nine or ten years. Various reasons have been assigned for such seemingly capricious movements. The alteration in banks and currents is said to make them change their situation. The Norwegians affirm, that the burning of seaweed in the manufacture of kelp, has forced the herrings to leave some of their shores. It is, indeed, probable, that the glare of kelp fires affects them with the same kind of terror which they have for lightning, and for that luminous appearance in the sea, called by fishermen, *waterburn*.

About the end of June, or rather early in July, the great shoal of herrings, seemingly from the north, appears towards the extremity of the Shetland islands. Gulls and gannets, screaming and in flight; whales and porpoises, rising and tumbling in the water, are the never failing harbingers of the approach of this immense body of fish, forming a surface or extent of several hundred miles. A great rippling in the sea is also observed; and sailors and fishermen aver, that they can nose them from afar by their strong oily smell. Soon after they come near to Shetland, they separate into various large divisions, some taking to the western and others to the eastern shores of Great Britain and Ireland. A few of these columns likewise cross the North Sea, or German Ocean; and the Swedes, about 1730, discovered a valuable herring fishery near to Gottenburgh, and which, from its contiguity to the Baltic, enabled them to undersell both the Scotch and Dutch, who formerly engrossed the whole of that trade. From their first arrival in July, they keep along both the east and west coasts of Scotland, and in October, after many erratic movements, they fix their residence where they mean to spawn. In these places they continue until the end of February, (sometimes, but rarely, longer,) and constitute what we call our winter fishery. In the Frith of Forth, for these several years past, this has been a very productive fishery; and during the present winter, 1814-15, the numbers of herrings there taken, and brought to the Edinburgh markets, have yielded a most abundant supply of nutritious food for the poorer class of the inhabitants of the city and its neighbourhood.

After the states of Holland became independent, (1579,) the herring fishery was carried on to an amazing extent; indeed the accounts given of it by various writers appear at this day almost incredible, although they, upon the whole, seem to be well authenticated. Sir Walter Raleigh was of opinion, that the Dutch made ten millions per annum of this fishery in his time. The great statesman De Wit, assures us, that in the year 1667, the Dutch employed no less than 2000 busses, and that upwards of 800,000 persons were subsisted in the two provinces of Holland and West Friesland alone by the herring fishery. The rise of the united provinces to their great importance as a nation, and to their being at one time rivals to the English in their marine, was entirely attributed to their perseverance and success in the herring fishery. The splendour and commercial consequence of their towns, sprung also from the same source, and it is acknowledged by themselves "that Amsterdam had its foundation on herring bones."

The great wealth, which the herring fishery, at an early period, brought to the Dutch, induced the Scotch to embark seriously into the same concern, and accordingly it was enacted, "That certain lords spiritual and temporal, and burrows, make ships, bushes, and boats, with nets and other pertinents," Jam. III. Par. 6. cap. 49. This act was confirmed by James IV. "that ships and bushes, with all their pertinents for fishing, be made in each burgh, in number according to the substance of the burgh, and the least of them to be of twenty tunn." Par. 4. cap. 49.

Letters patent were granted by Charles II. to establish the Company of the Royal Fishery of England. This erection was, however, rescinded by an act of William and Mary, declaring it to be dissolved.

The first bounty for the exportation of herrings, was granted by the Scotch Parliament in 1705. A bounty of 10s. 4d. Scotch was then paid on every last of herrings exported in whatever way they were caught, and upon a last taken by busses and exported £18 Scotch was allowed. The same act remitted the duties payable on all materials used in the fishery.

Two years after this enactment, the Union took place, from which period the herring fishery seems to have been in a declining state, in spite of all the props, with which it has been supported, and the liberal premiums given for its revival. In 1720, a general copartnery was formed for the purpose of raising this fishery from its languor. It consisted of about 2000 of the principal people in Scotland; their capital was divided into shares of £100 each; but, like the South Sea bubble, which burst about the same time, the whole concern soon vanished into air.

In 1727, the Board of Trustees was established, to whom the management of £2000 per annum was given from the revenue of Scotland, for the encouragement of the manufactures and fisheries of that country. We cannot say what part of this sum was, or is now appropriated for the herring fishery.

In 1750, the Free British White Herring Company act passed in Parliament, whereby it was enacted, that a capital might be subscribed of £500,000, the proprietors to receive 3 per cent. per ann. upon the sums paid in during fourteen years. A bounty was also allowed of 30s. per ton for all busses from 20 to 80 tons employed in the service of the company. His Royal Highness the Prince of Wales, (who was enthusiastically fond of the undertaking,) was chosen governor. This national association, although patronized by the first people in the kingdom, and promising fair in every point, was soon after its establishment given up. By this act it was likewise declared, that every fishing company, at any port in Britain having a capital of £10,000, should also be entitled to the same premium and bounty as allowed to the aforesaid Free British White Herring Company. Neither did this appendage to the act succeed better.

In 1753, 1755, and 1756, three other acts of parliament were passed, regulating more particularly the mode of fishing with busses.

Another act took place in 1757, by which the bounties to busses were increased from 30s. to 50s. per ton. This liberal encouragement induced many owners of vessels to enter as adventurers in this trade; and in the course of the year 1767, so large a sum as £31,396 was paid in Scotland to persons engaged in this fishery. By an act passed in 1771, this bounty was again restricted to 30s. per ton, by which means the bounties paid in Scotland became trifling, and in England, for one or two years, no bounties for herring busses were claimed.

In 1779, another act was passed, followed by an interim one, by which the herring fishery continued to be regulated, until the Highland Society of Scotland took up the business of this neglected, ill-conducted fishery, by investigating the causes of its decline, and the means most likely to bring about its revival and improvement. The steps which they thought necessary to take for these purposes were, to offer liberal premiums for approved essays on the Natural History of Herrings, containing observations on the causes that induce them to leave their usual haunts, the modes of capture that have a tendency to render the fishing less productive, &c.

Having received several communications on the above subject, and after much investigation, and various correspondences relative to this fishery, the Society, with the assistance of other gentlemen, set about framing a bill, that was brought into parliament in 1808, when it passed; of which the following is an abstract.

It is entitled, An act for the further encouragement and better regulation of the British White Herring Fishery, until the first day of June 1813, and from thence to the end of the then next session of parliament.

A bounty of £3 per ton shall be paid annually to the owner or owners of any whole decked buss or vessel of not less than 60 tons burden, being British built, owned, navigated, and registered according to law, which shall be fitted out for, and actually employed in the Deep Sea British White Herring Fishery, but that such bounty shall not be paid on any number of tons more than 100, although the buss should be of greater burden.

For every barrel containing 32 gallons of white herrings caught in the British fisheries, and landed in Great Britain, a bounty of 2s.

The number of trustees for manufactures, fisheries, &c. in Scotland, to be increased from 21 to 28, whereof his Majesty may appoint seven to be commissioners for the herring fishery.

The Admiralty to have the appointment of an officer of the navy to be superintendant of the Deep Sea British White Herring Fishery, who shall annually proceed to Brassey Sound in Shetland, and be at this place of rendezvous by the 15th of June, and shall remain with the vessels employed in that fishery during the continuance of the season, and shall from time to time, when required, transmit to the commissioners of the Admiralty, as also to the commissioners of the fishery, a list of the busses employed in the said fishery, with the number and ages of the men on board thereof, distinguishing the capacities in which they respectively act.

The Treasury to appoint officers of the fishery, to inspect and take account of all herrings landed or exported, and to certify whether the fish are properly cured and packed, so as to be entitled to the bounty of 2s. per barrel; and in order that such officer may be duly qualified for this purpose, they must have exercised the trade of a cooper, and be otherwise skilful in this business.

No net to be used that has a mesh less than one inch from knot to knot.

No buss or vessels to be entitled to the tonnage bounty thereof, unless such vessel have on board (put up in new barrels) sixteen bushels of salt at the least, for every last of herrings which such vessel shall be capable of containing, and also as many more new barrels as such buss or vessel is capable of carrying; nor unless such buss shall have on board 300 square yards of netting at the least, for every ton of her admeasurement, together with the customary quantity of other materials, for the equipment and mounting of the quantity of netting hereby required to be provided; nor unless she be manned with the number of men following, at the least; that is to say, with ten men, if such vessel shall not exceed the burthen of 60 tons; if she shall exceed the burthen of 60 tons, and shall be under the burthen of 70 tons, with 11 men, and if such buss or vessel shall be of the burthen of 70 tons or upwards, then with one man more for every ten tons by which such vessel shall exceed 70 tons, two of which number respectively may be foreign seamen, experienced in the deep sea herring fishery. A vessel of upwards of 100 tons is not required to have more men, salt, or netting, than one of 160 tons. The full number of men, as above stated, are not deemed necessary until the arrival of the buss at the rendezvous of Brassey Sound.

The owner or owners, in order to obtain the tonnage bounty, is to give notice in writing to the officer at the port of outfit, the name of the buss, of the owners, of the master, the quantity of salt, netting, number of barrels, &c. and declare that such vessel is sufficient, and in every respect fit and proper for such voyage and fishing; and if the officer is satisfied that every proper regulation has been complied with, he shall certify the same on the back of the notice, and one or more of the owners or their agent, and the master of such vessel, shall respectively make oath before an officer of the fishery, that it is truly his determined purpose, that such vessel as then furnished and provided, shall forthwith, after license shall be granted, proceed to *Brassey Sound* in *Shetland*, and be there on or before the 22d day of June (having on board the number of men required), and shall not wet or shoot her nets before the 24th of the same month, and shall fish for herrings in the Deep Sea Fishery, in the manner following; that is to say, the crew shall shoot and haul the nets directly from and into the said buss or vessel, without the intervention or use of a small boat, the nets being attached to the vessel while they are set, the vessel not being at anchor when the crew are shooting the nets, during the time the nets are set, nor while the crew are hauling or taking them in; and shall cure all the herrings taken or caught in the said nets in barrels, and not in bulk on board such vessel, and that the crew shall continue fishing upon the coasts of Great Britain and Ireland, from the said 24th of June until the 15th of September, the owner giving bond, with sufficient surety, (which is exempted from stamp duty), that all requisites have been performed, then the officer of the fishery shall give to the master a license to proceed on his voyage to the rendezvous.

After the vessel has arrived at Brassey Sound, the superintendant, if satisfied that she is completely stored, and has on board the number of men required by this act, then he is to give a certificate declaring that the said buss is entitled to commence the said Deep Sea White Herring Fishery for the tonnage bounty. Herrings taken every day by the crews of the busses to be distinguished by a mark on the barrels in which they are cured.

Herrings may be transhipped out of a buss at the Deep Sea Fishery into another vessel, previously to the 16th of July, and carried into port.

The master of every buss employed in the Deep Sea Fishery, must keep a regular journal, in order to be entitled to claim tonnage bounty.

Commissioners of the fishery to enquire into any matter of complaint stated in the report of the superintendant, against the conduct of the master or crew of any buss, and determine thereon.

The officer of the fishery at each port to attend the landing of the herrings, and of the salt and barrels which have not been used out of each buss, and take account thereof, and certify the same.

The officer of the fishery at each port, shall transmit, without delay, the license, the master's oath, and the officer's certificate made on the return and discharge of each buss, &c. to the commissioners; and if they shall be satisfied that all regulations directed by this act have been observed, they shall immediately give a debenture to the owner, with a notice of their having granted such to the commissioners of Excise in England or Scotland, who are to give an order to their cashier or collector nearest the port where the buss discharged her cargo, who is to pay the sum mentioned in the debenture on demand.

Mariners employed in the deep sea fishery are protected from being impressed during the voyage, and until after the buss has returned to the port of her discharge.

Owners of busses entitled to the tonnage bounty, to pay the crew 2s. per barrel on the herrings taken and cured by them.

An additional bounty of £1 per ton is allowed for the first 30 busses fitted out for and employed in the herring fishery, and entitled to the bounty of £3 per ton.

Then follow regulations for cleaning out vessels, (other than busses on the tonnage bounty), with salt, &c. for the British herring fishery, what herrings shall be entitled to the bounty of 2s. and certain herrings are prohibited from being exported.

Herrings may be cured and packed in half barrels, containing 16 gallons English wine measure, and two of these being accounted equal to one, 2s. bounty shall be paid on them.

For encouraging the inhabitants on the sea-coasts of Scotland, to provide larger boats than are now used in the herring fishery, and to take herrings at a greater distance from shore than can be done in small boats, it is enacted, that after the 1st of June 1809, the commissioners are authorised to allow premiums or bounties, not exceeding the sum of three thousand pounds yearly, to persons who shall employ boats of a burthen not less than fifteen tons by admeasurement, in the taking herrings on the coast of Scotland, and who shall cure and pack them according to the rules and regulations of the commissioners. This bounty also to be paid by the commissioners of Excise in Scotland."

When the foregoing act expired, which was at the close of the last session of parliament, (1814,) an interim one took place. This was a temporary expedient, until a bill should be brought in this season, after the Easter recess, to obtain an act for permanently regulating this fishery. This act, as we are informed, is to be in substance, nearly the same as that of which we have given an abstract, and both modelled (with the exception of the bounties) after a placart or ordinance published at the Hague and Delft, by the states of Holland and West Friesland, in the prime and most successful state of their fisheries, concerning the catching, salting, curing, packing, heightening and laying of herrings, &c.

The fine shape, with the peculiar pleasant flavour of the Dutch herrings, owing to their excellent mode of curing, caused them to be more esteemed throughout Europe, than either those of the English or Scotch. However, it is to be hoped since the value of this fishery seems now to be properly appreciated and attended to, that our pickled herrings will be equal, if not superior, to the best of the Dutch, or those of Gottenburgh.

The first idea of preserving herrings by pickling, is said to have been suggested about the year 1390, and it was the cause of that fishery becoming afterwards so valuable an article of commerce.

William Bruckfield, or Beukelings, a native of Bierolict, a town of Dutch Flanders, who lived about that time, has got the merit of being the first discoverer of

Herring Fishery.

this pickling process.* We suspect, however, that the fishermen and inhabitants of the town of Yarmouth, in the county of Norfolk, knew the art of preserving and barrelling both red and white herrings before that period. It appears to have been a great and lucrative branch of their trade from the 1806 to 1360, and we see a statute of Edward the Third, in the 31st year of his reign regulating the herring fair and fishery of that place. Bruckfield perhaps improved on the art, but to the merit of the discovery, we do not think him entitled.

According to the time of taking, and mode of curing herrings, they receive various appellations, as, seasticks, summers, crux, corved, and shotten herrings.

When they are intended to be cured with what is called the white pickle, they are cut open, and the guts carefully separated from the milts and roes. Then casting away the guts, and leaving the milts and roes entire, the herrings are first washed well with water, and then put into a brine strong enough to bear an egg, where they are allowed to lie from twelve to sixteen hours; then they are taken out, and after being well drained, the salters begin packing. They first of all strew a quantity of salt, as even as possible, over the bottom of the barrel, and lay a row of herrings over it, sprinkling also some salt over them, and so on, till the whole be completed. The firmer the herrings are packed, they keep the better; and the salters therefore press them down with their hands in the packing, as closely as possible, and before heading the cask, they strew about a platterful of salt over the uppermost row. When the barrel is thus filled, they stop it up very close, lest the air should get in, or the brine flow out, either of which circumstances would be destructive of the fish.

Red herrings.

On the coasts of Norfolk and Suffolk, a considerable herring fishery is carried on from September to the end of October. The fish which they generally cure there, are called red herrings. When a boat is loaded, it immediately makes for the shore, and delivers its cargo of herrings to persons who are employed in the gutting and washing of them. After this is done, they are put into a tub with salt, where they remain for twenty-four hours; they are then taken out, and put into wicker baskets, washed, and spitted on small sharp wooden spits, and hung up in chimnies in their *herring hangs*, where fagots are kindled on the floors, for the purpose of drying them. These places will hold ten or twelve thousand at a time. This process of drying is generally ended in about twenty-four hours, and then they are taken down, and put into barrels for keeping. Herrings, when thus cured, have a bright yellow, golden appearance, and from their fine flavour, are in much request, both at home and abroad.

Sect. III. *On the Lobster Fishery.*

Lobster fishery.

The eastern and rocky shores of Scotland abound with this fish, which is the *Cancer Gammarus* of Linnæus; and the great quantities of it sent to the London market, form a very lucrative article of trade. Lobsters are generally found in deep, clear water. They breed in the summer months, and it is said propagate *more humano*. They are very prolific, and deposit their *ova* in the sand. On the 11th of August, Mr Harmer found in a lobster of thirty-six ounces, the weight of spawn to be 1671 grains, and the number of eggs 21,699. About the 1st of June, they commonly cast their shells, and nature, in a little time, supplies them with a new one. Before this necessary change, the animal swells, and ceases to take its usual food. Many of them die under this painful and violent operation. They only grow in size when their shells are membranous and soft. If any of their claws are torn off by accident, they soon renew them. They remain in season from September to June. The shell is black before it is boiled, but afterwards becomes red. During winter, the cock is supposed to be more delicate eating than the hen lobster. They are taken in what fishermen call *pots*, which are made either of netting or twiggen work; these, after being baited with garbage, are made fast to a rope, and thrown to the bottom of the sea, where it may be found to be from six to ten feet deep. A buoy is also affixed to them. These pots or baskets resemble a mouse trap, which admits the animal, but prevents his return. On the Yorkshire and Orkney coasts, the fishermen use small nets, with iron hoops, baited with fish guts, and pieces of dried dog fish.

The metropolis makes use of more lobsters than all the kingdom beside. It is chiefly supplied from the British Channel, the coasts of Yorkshire, Northumberland, the Frith of Forth, the eastern shores of Scotland, and Norway, from which last place, a million has been brought in one year. The well smacks, which run from Long Hope in Orkney, afford also a very large supply for the London market. The lobsters which they take or purchase from the Orkney fishermen, after having tied up their large claws, in order to prevent their killing one another, they put in chests, which contain four or five hundred each, and when they collect about 9000, they then stow them aboard the first smack that is to sail for Queenborough, from whence they are taken up in boats to Billinsgate.

By 10 and 11 William III. cap 24, no lobster is to be taken under eight inches in length, from the peak of the nose to the end of the middle fin of the tail; and by 9 Geo. II. cap. 33. no lobsters are to be taken on the coasts of Scotland, from the 1st of June to the 1st of September. See our article Crustaceology, Vol. VII. p. 398—400.

Sect. IV. *On the Mackerel Fishery.*

Mackerel fishery.

The mackerel fishery, although a very valuable one for the metropolis, by supplying it plentifully with this fish, is not carried on to much extent in any part of Britain, except in the Channel, and on the coasts of Essex, Suffolk, and Norfolk. The mackerel (*Scomber scomber*, Lin.) is a fish of passage. It remains, during winter, in the deep seas, and does not come on our shores until April or May. It is generally about 17 inches in length, and weighs nearly two pounds. The body is long, round, thick, and fleshy, but very small and slender towards the tail, which is so much forked, that it seems to be almost parted into two distinct fins. Its fecundity is very great; for, according to Hanmer's table, he found one in the month of June containing 546,681 eggs. It exhibits a phosphoric light when newly taken. From its shape, so finely calculated for swimming, it has been proposed as a model for the building of ships. Mackerel are found on the coasts of Normandy and Picardy, and from the Lands End in England to the Red Head in Scotland, gradually decreasing in numbers, from

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* The Emperor Charles V. coming to the Low Countries, paid a visit to the town of Bieroliet with the Queen of Hungary, to honour the memory and to view the tomb of this supposed first pickler of herrings.

Yarmouth northward. It has been often mentioned, that this fish was in high esteem by the Romans, because it furnished the *Garum*. We suspect, however, that this is somewhat doubtful, as mackerel are not plentiful in the Mediterranean, and that this precious preparation was rather obtained from the *Scomber Thynnus*, or tunny, called in Scotland mackerel-sture, fish which abound on the Spanish, French, and Italian shores in that sea.

The eyes of the mackerel, when they first appear on our coasts and during winter, are covered with a kind of white film; they are then nearly blind, this, however, they cast in the beginning of summer. Mackerel are taken either with angle lines or nets. A red rag is an excellent bait for them, and they snap at it freely and greedily, when, according to the seaman's phraseology, *it blows fresh*, or what Dryden calls *a mackerel gale*. This fishery continues in the English Channel about four months in the year. Mackerel are chiefly caught for immediate consumption in the home market, an astonishing number being sold fresh every year in London. Some are pickled, and exported in barrels from England; but this trade has of late much declined, as the West India islands are mostly supplied with this article from Nova Scotia, New Brunswick, &c. Although mackerel are sometimes pretty numerous in the latter part of the season about the Isle of May, and the mouth of the Frith of Forth, very few are brought to the Edinburgh market. See our article ENGLAND, Vol. IX. p. 13.

SECT. V. *On the Oyster Fishery.*

ster fish-

THE oyster (*Ostrea edulis*) is a bivalvular testaceous fish, and is to be found in various parts of the kingdom. It is well known, and much esteemed, as a most wholesome and nutritious food. The oysters of Britain, although not the largest, are allowed to be the best in the world. They were so famous for their excellence in the days of the Romans, that, according to Juvenal and Pliny, they were carefully conveyed from Sandwich to Rome; indeed, the *Rutupina littora*, (waters and shores of Kent,) were noted by these luxurious people, chiefly for their producing this fish. The oysters of Colchester in Essex, and some other parts of England, are perhaps however little inferior to those of Kent. In Scotland, they breed in the creeks and bays of the Orkney and Western Islands; but the most considerable fisheries carried on in this country for oysters, are in the Frith of Forth, near to the Isle of Inchkeith, and Prestonpans, in Musselburgh Bay, which last place is remarkable for oysters of great size and delicate flavour. They get the appellation of *Pandoors*, from being taken close by the doors of the salt pans. The beds or *scalps* there, are not at this day nearly so productive as formerly, being overdredged, to answer the great demand for these oysters, not only in the Edinburgh market, but in that of Glasgow.

Oysters generally cast their spat, or spawn, in the month of May; when first shed, it has the appearance of a drop of candle-grease, and adheres to stones, or any other hard substance, which the dredgers technically term *cultoh*;—the spat is covered with a shell in two or three days, and, in the course of three years, it becomes of a marketable size. The dredgers make use of a peculiar kind of net, which is very thick, strong, and fastened to three spills of iron: this they drag along the bottom of the sea, and thus force the oysters into it. In England, many, after being taken in this manner, are carried to different places, and laid in beds, or pits of salt water, in order to feed and fatten. A green colour is often artificially given to them in the salt marshes; but we do not consider it as any improvement, as we think white oysters both look, and taste, better than those that are green. The sea star (*Asterias glacialis*) is a most destructive animal in a bed of oysters, because it clasps its rays around the shell, and perseveres till it sucks the animal out. The fishing for oysters is permitted from the first of September to the last day of April inclusive; or oysters are in season, according to vulgar observation, in all those months which have the letter *r* in their name. See our article CONCHOLOGY, Vol. VII. p. 98, genus OSTREA; and our article ENGLAND, Vol. IX. p. 14.

SECT. VI. *On the Pilchard Fishery.*

Pilchard fishery.

THE pilchard forms a distinct species in the genus *Clupea*, (*C. pilchardus*.) There are several naturalists, who insist that it is only a variety of the herring; however, we have various reasons for thinking otherwise. It is less and thicker than the herring, the nose turns up, the under jaw is shorter than the upper, the dorsal fin is placed exactly in the centre of gravity, for if you take a pilchard by the back it will hang even, which a herring will not do; the scales are firm, and adhere very closely, whereas those of the herring come off with the smallest touch.

The pilchard is a fish of passage, swims in shoals, and its arrival on the coasts of Bretagne, Cornwall, and Devonshire, is indicated by similar signs with the approach of the herring towards Shetland. The season of this fishery is from June to September, although they are sometimes caught about Christmas.

On the jutting cliffs, upon the coasts of Devonshire and Cornwall, men are set, whom they call *huers*, to watch the coming of the pilchards; the purple colour of the water in the day, and its shining appearance in the night, give certain indication of their approach. Then the *huers*, according to settled and regulated signs, direct the boats and vessels how to manage their seins, and when their commands are properly given and obeyed, they have been known to take, in their nets, 100,000 pilchards at a draught. It is a common saying of the Cornish fishermen, when talking of the pilchard, that it is the least fish in size, most in number, and greatest in gain, of any they take out of the sea.

In Scotland there are no established fisheries for pilchards; they sometimes appear among the herring shoals, especially in the Frith of Forth, where they are accounted a very insipid fish. See our article ENGLAND, Vol. IX. p. 13.

SECT. VII. *On the Salmon Fishery.*

Salmon fishery.

IN order to understand our account of this fishery, it will be requisite to have a slight knowledge of the natural history of the salmon, (*Salmo salar*,) but as we have already given this in our article ANGLING, we shall not resume this subject at present.

It is scarcely in the power of human skill to reduce the numbers, or extinguish the race of such fish as make the sea their only element. But this is not the case with fresh water, or rather fluviatile fishes, which being confined in narrow limits, are consequently within the easy reach of the avaricious contrivances of men, and that too without their encountering either the toils or dangers attendant upon the fisheries of the seas. Indeed, had it not been for the restraining statutes respecting the manner and times of catching them, the breed of salmon would, in all probability, have been long ere now extirpated.

Several of the genus *Salmo* are anadromous fishes, or such as alternately inhabit fresh and salt waters; all of them, however, spawning in the heads of rivers, or in brooks connected with them. After performing this function, they become lank and sickly. In this situation they make for the sea, no doubt to recover from their shotten state. After remaining there for a few weeks, an irresistible impulse of nature hurries them again to their native streams. To accomplish this object, they set all kinds of obstacles at defiance, and would rather perish in the attempt than deviate from their course. They never spawn until they reach these shoals, and if obstructed or retarded in their ascent, they are often forced to drop their roes in the lower parts of rivers, but which, in that case, are never known to be either impregnated or covered by the milter. It has been remarked that their periodical migrations are in part prompted by another circumstance. During their residence in the rivers, they are infested by parasitical insects, which are killed by the salt water; but in the sea they are soon attacked by the *lernea*, which perishes in fresh water.

The importance of the salmon fishery to Scotland, induced the legislature, at an early period of our history, to enact various statutes, for the preservation and multiplication of the breed, and for prohibiting all kinds of apparatus in their capture, which might tend to a diminution of their numbers. Such is the spirit of our laws respecting this valuable fishery. But within these thirty or forty years, the existing laws have not been duly enforced, and, of course, a great and sensible decrease has taken place in all the waters of Scotland; and, indeed, in many rivers in which they used formerly to abound, scarcely one is now to be seen, as for example, in the Almond and Ericht in Perthshire, both branches of the Tay. In the upper parts of the Tweed, from Kelso to Drumelzier, there were formerly several established salmon fisheries, but these are now entirely relinquished, from the small number of fish which ascend to that part of the river. The cause of this scarcity is imputed to the modes of fishing with stage, toot nets, &c. at or near to the mouth of that river.

Although we only mention these circumstances as coming within our immediate knowledge, we believe that the same decrease may be observed in the interior parts, as also in the tributary streams of all the principal rivers in Scotland.

It has been contended by many of the lower proprietors upon our rivers and estuaries, that stake nets, and other such sweeping devices, do not lessen the breed of salmon; that the Scotch acts of parliament are now in desuetude; and even if they were still in force, that they do not apply nor allude to such apparatus, nor to the passage of salmon upwards, but only to the preservation of the breeders in close or fense time, and to the smoults, fry, or salmon seuse.

The most material object, undoubtedly, in the propagation and preservation of the salmon species, is to afford them a safe passage to their parent stream, that bed which nature has pointed out to them as the safest and best, in which they can lay the seeds of their future offspring. We have, indeed, already noticed, that, if they are prevented from reaching this spot, the spawn is rendered unprolific, by their dropping it without any farther care or concern.*

That our statutes have the protection of this passage upwards in view, we apprehend can hardly be questioned. The prohibitory clauses respecting the use of certain nets, devices, &c. the observance of close time, of the Saturday's *slap*, of the mid stream, &c. all corroborate this supposition. Indeed, amidst the various laws enacted by the Scottish parliament for the preservation of the breed of this fish, it would be an absurdity to imagine, that the most effectual safeguard for their propagation should be neglected; that is, a complete protection in their ascent to the spawning grounds.

As the law at present stands, we consider all modes in the capture of this fish to be illegal, unless by angling, by the net and cobble, or by the common seine, of moderate and fixed dimensions. But to prevent all disputes, and to meet the exigency of the times with regard to the preservation of salmon, we apprehend legislative interference would have at present an excellent effect, not only in settling such means as may render this fishery permanent and productive, but would put an end to the many litigations that take place between the upper and lower proprietors of our salmon rivers.

Notwithstanding the ancient, and seemingly correct laws for the conservancy of the Thames, yet trespasses increased so much, and the offences in fishing became so intricate and destructive, that the city of London found it necessary and expedient, in the 30th year of the reign of George II. to obtain another act of parliament, for the better regulating the fisheries in that river, and in the waters of Medway. In pursuance of this statute, the lord mayor (Clark) in 1785 published a set of rules, orders, and ordinances, containing penalties for a breach of the same; and annexed to this publication, are notes by the Lords Mansfield and Loughborough approving thereof.

From these ordinances, now acted upon in the court for the conservation of the river Thames, we select the following articles, being, as we think, not only well adapted to, but somewhat explanatory of, the spirit of both the Scottish and English laws with regard to our salmon fisheries.

"*Imprimis*, That all unlawful nets and engines, and other abuses, offered to the prejudice and destruction of the fishery, may be discovered. That no person shall stall the tide of flood.

2. *Item*, That no person shall lie or bend over any net whatsoever during the time of flood, whereby any kind of fish may be hindered or kept back from swimming upwards, for the benefit and profit of such fishermen, as well above London Bridge, in the west part of the said river, under penalty of forfeiting and paying five pounds for every such offence.

3. *Item*, That no person shall shoot, or place any draw net, cod net, or other net or engine in the said river Thames, to catch salmon with, or shall use any net or device to catch salmon in the said river of Thames, except only with a net of full six inches in the mesh, and that no person shall wilfully do, or commit, or cause to be done or committed, any act whatsoever in the said

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* The Irish complain much of the decrease of salmon in their rivers; and Wakefield, in his Statistical Account of Ireland, mentioning the modes of capture in some of their fisheries, observes, that "flood are more injurious than ebb weirs, as they catch the fish in their ascent." Vol. ii. p. 98.

iver Thames, whereby any spawn, or small fry of salmon, shall be taken, killed, or destroyed, or whereby my salmon shall be hindered from passing or going up he said river Thames to spawn, upon the penalty of orfeiting five pounds for every such offence.

4. *Item*, That no person, between the 10th day of eptember and the 25th day of January in every year, hall fish in the said river of Thames, or waters of Medway, for salmon, with any net or nets, engine or device; r within that time take, kill, or destroy in the said river or waters salmon of any kind, or offer them for sale, nder the penalty of five pounds for every such offence.

5. *Item*, That no person shall fish with any net, or ay or haul any mesh, engine, or device whatsoever in he said river or waters, from sun-setting on Saturday ight, until sun-rising on Monday morning, at any time f the year, under a penalty of forty shillings for every uch offence.

18. *Item*, That no person shall bend any net by anhors, or otherwise thwart the channel, or draw any ther net, engine, or device, into, upon, or near it; or se any net with any false or double bottom, cod, or ouch, under the penalty of five pounds for every such ffence.

20. *Item*, That no person shall fish, or attempt to ake fish, with any sort of net in the night-time, or before sun-rising, or after sun-setting, at any time in the ear in the said river Thames, between Richmond ridge and the city of London's mark stone above Stainesbridge, under a penalty of five pounds for every uch offence.

24. *Item*, That no salmon caught in the Thames or Medway, shall be exposed to sale of less weight than ix pounds, under a penalty of five pounds.

47. *Item*, That no person shall put down at the mouth f any creek, river, or back water, growing out of the Thames or Medway, or communicating therewith, or unning into the said river or waters, or at any mill or luice within the said jurisdiction, any frame net, hoop et, or purse net, or any weel or device whatsoever, to top, catch, or hinder the fish, or spawn, or fry of fish, rom coming into the said river or waters, under a penalty of five pounds for every such offence.

55. *Item*, That no person shall have, or occupy, or ix up, drive down, or place, or cause to be fixed up, rove down, or placed in any part of the said river Thames or waters of Medway, any wear, stank, stop, atch, weel, reel, or other device to take fish in, within he jurisdiction aforesaid, under a penalty of five pounds or every offence, in breach of any part of this order."

Such are the ordinances respecting the salmon fishry observed in the court, held before the lord mayor or the conservation of the Thames. It is the duty of he water bailiff, or his assistants, to give notice of tresasses, and the persons committing them never escape npunished. The above articles are not enumerated n order, as the intervening ones apply to other fish than he salmon.

It is much to be wished, that similar regulations were nacted for the conservation of our rivers in Scotland. hat salmon have of late years greatly decreased in numers, and are still fast decreasing, we believe will not e disputed by any one, and it can hardly be expected at this fishery will flourish, until all devices and modes f fishing which prevent them from easily reaching eir spawning grounds be effectually removed. For is purpose, all stake, took, and other stationary nets, ould be prohibited and declared illegal. A purchase all cruives should be made from those persons, who by particular grants now inherit or possess them. Rights of property, held to be inconsistent with the common weal, have, in the cases of tithes and thirlage in Scotland, already been the subject of legislative provisions, the object of which was to remove the incumbrance on the general prosperity, without injury to the owner. Perhaps the justice and expediency of this interposition are still more obvious with regard to rights of fishing, by modes injurious to the fishery at large; for each proprietor of such rights has a direct interest in the benefit that might result from a judicial sale of these, because, after obtaining the value of his peculiar privilege, he would share in the increase of the general fishery.

If any alteration should take place in the laws regarding the capture of salmon, fence time, in Scotland termed *close time*, should be prolonged, and extended indiscriminately to all the rivers in Britain; that is, beginning upon the first of August, and to continue until the end of January, or from Lammas till Candlemas day. This would prevent any interruption to salmon in the month of August, when heavy with milts and roes in making up to the head waters for the purpose of spawning. It would also save many shotten fish from being taken in December and January, when on their passage to the sea.

There seems to be no general law respecting the fence months in the rivers of Scotland, all the fisheries commonly commencing and ending at different times, according to various acts of parliament. In the Forth and Tay, the fisheries begin on the 11th of December, and terminate on the 26th of August. In the Tweed, they fish from the 11th of January to the 10th of October. In the north Esk in Kincardineshire, from Candlemas to Michaelmas. In the Dee and Don, from the 11th of December to the 19th of September. In the Spey, from the 30th of November to the 26th of August.

We cannot accurately ascertain the periods of fishing in our other principal salmon rivers, which, beside the many tributary streams, are, the Clyde, Luce, South Esk in Forfarshire, Doveran, Ness, Beauly, Thurso, and the Annan, with others running into the Solway Frith.

The chief rivers in England frequented by this fish, are, the Thames, Medway, Severn, Mersey, Trent, Dee, Ex, Usk, Wye, Lon, Weever, and Tyne.

London is principally supplied with salmon from Scotland. When fresh, they are sent packed up with ice in boxes; and those that are pickled in small kits, such as were first used in Newcastle for that purpose. Although the sums drawn in this country from the metropolis come to a very considerable annual amount, yet were proper regulations for this fishery established by law, and duly enforced, not only a great increase in the trade would take place, but Scotland would be more abundantly provided in salmon for home consumption.

For an account of the WHALE FISHERY, see WHALE FISHERY; an account of the PEARL FISHERY, will be found in our article CEYLON, Vol. V. p. 700; and of the ANCHOVY FISHERY under our article ANCHOVY. See also IRELAND. (A. D.)

FISHES, ELECTRICAL. See ELECTRICITY *Index*.

FISHING. See ANGLING.

FISTULA. See SURGERY.

FIUME, or ST VEIT, is a sea port town of Istria. It is situated on the Bay of Fiume, in the Gulf of Venice, at the mouth of the Fiumara or Reka, at the commencement of a narrow valley, abounding in wines and excellent fruits. The town is agreeably built, and contains several good public buildings. The churches are particularly magnificent. The cathedral, which was not finished when Keysler visited this city, was adorned with several beautiful marble pillars and statues. The Jesuit's church is of a circular form, and has a small cupola. Fiume has long been celebrated for its wax manufactory, and the refinery for sugar supplies the whole of the Austrian states with that article. Many individuals find employment from these two establishments. The harbour, which is formed by the river Fiumara, is well frequented. There are here several considerable commercial houses, and great quantities of goods which come from Hungary are exported from this place. The town is populous. East Long. 14° 42′, North Lat. 45° 45′. See Keysler's *Travels*, vol. ix. p. 122, 8vo; and L. F. Cassa's *Travels in Istria and Dalmatia*. (w)

FIXED Sound of M. Sauveur. About the beginning of the 18th century, the author above named took a great deal of pains, in endeavouring to introduce a greater degree of precision into the notation and practice of music, and with the view of determining the pitch, he proposed, that A in the lowest space of the bass stave, should be denominated the *fixed sound*, and make just 100 complete vibrations in one second of time. Now the tenor cliff C being a minor tenth ($\frac{5}{12}$) above this A, we have 1200÷5=240 for the vibrations of this C, which being also the result of several modern experiments on this subject, (see our article Concert Pitch,) we have always used this pitch in calculating vibrations and beats in our work.

M. Sauveur also proposed another fixed sound cr pitch, which has since been adopted by Dr Thomas Young, and some other writers, in which an imaginary C, eight octaves below the tenor cliff C, should make exactly one vibration per second; and consequently the latter would make 256 vibrations, which is to 240 as 16 : 15, shewing that the former pitch is just a major semitone higher than the latter one in present use; and that for the mere purpose of simplicity of description, an erroneous idea of the actual pitch has thus been conveyed to the student, but which future writers may avoid, by representing the fixed sound 1 per sound, as belonging to D♭, eight octaves below that, which is the next above the tenor-cliff C. (ε)

FLAME. See Chemistry.

FLAMSTEAD, John, a celebrated astronomer, was born, according to some, in the village of Denby, in the county of Derby, on the 19th of August 1646, although others maintain that he was born in the town of Derby. The registers of both of these parishes were examined in order to ascertain this point, but his birth does not seem to have been registered, probably on account of the commotions which at that time agitated England. His father resided at Derby, and he received his classical education at the free school of that place. At the age of 14, a severe illness obliged his friends to take him home, where the accidental perusal of Sacrobosco's treatise *De Sphæra* inspired him with a passion for astronomy. By means of the Caroline tables, published by Street, he was instructed in the method of computing eclipses, and the places of the planets. One of his calculations of an eclipse, procured him the friendship of Mr Emanuel Halton, residing at Wingfield manor, who was well acquainted with the mathematics, and who supplied young Flamstead with the best astronomical works then extant, among which were Riccioli's *Almagestum Novum*, and Kepler's *Rudolphine Tables*. With these aids he made rapid advances in the knowledge of astronomy, and in the year 1669 he sent a paper to Lord Brouncker, President of the Royal Society, entitled, "*An Account of such of the more remarkable Celestial Phenomena of the year* 1670, *as will be conspicuous in the English Horizon*."

This paper was read and approved of, and obtained for young Flamstead the friendship and correspondence of some of the first astronomers in London. In the year 1670, Flamstead undertook a journey to London, for the purpose of seeing his scientific friends; and he had the good fortune to become acquainted with Sir Jonas More, Mr Collins, and Mr Oldenburg, the first of whom was ever afterwards his patron and warmest friend. When in London, he purchased two telescopes, a micrometer, and several other instruments with which he had not been provided. After leaving London, he entered himself a student of Jesus College, Cambridge, where he became acquainted with Dr Barrow and Sir Isaac Newton. As soon as he returned to Derby, he resumed his astronomical studies. In 1671, he sent to the Royal Society calculations of the appulses of the moon to several fixed stars, for the year 1672; and about the end of the same year, he transmitted another communication, containing his observations on the ansæ of the planet Saturn, made with telescopes, the largest of which was fourteen feet long. In the same year, he observed, with a Townley's micrometer adapted to the preceding telescope, the relative position of the principal stars in the Pleiades, and he computed their occultation by the moon in the subsequent year. In 1673, he composed a treatise on the true and apparent diameters of the planets, which Sir Isaac Newton employed in the 4th book of the *Principia*. When he was in London in 1674, Sir Jonas More having informed him, that a true account of the tides would be acceptable to the king; he composed a small ephemeris for his majesty's use. He likewise recommended himself to the royal favour, by presenting to his Majesty a pair of barometers, with the method of using them. Having resolved to enter the church, Mr Flamstead was ordained by Bishop Gunning in 1675, but several years elapsed before he obtained any preferment. Through the influence chiefly of Sir Jonas More, King Charles II. was prevailed upon, in 1675, to found the royal observatory of Greenwich, afterwards called Flamstead-house, and to appoint Flamstead to the office of Astronomer Royal, with a salary of £100 per annum. On August 21, 1676, he observed at Greenwich, the occultation of Mars. In the beginning of 1677, he observed the comet of that year. In the year 1681, Flamstead's *Treatise on the Doctrine of the Sphere* was published in Sir Jonas More's *System of the Mathematics*; and in 1687, he was presented to the living of Burslow in Surry, which he retained till his death.

As soon as he had entered upon his new office, Flamstead directed almost the whole of his attention to practical astronomy. By means of the best instruments of the times, he observed the lunar motions with great assiduity, and he determined the places of the fixed stars with much greater accuracy than had been done before. Contrary to the wishes of Flamstead, an edition of his observations was published in 1712, by Dr Halley, in one volume folio; but as he would never acknowledge this work as his own, he prepared a new edition of it, but before its completion he died of strangury on the 31st of December 1719, in the 73d year of his age.

Mr Flamstead was admitted a member of the Royal

Society on the 13th of February 1678, and he contributed to the transactions of that learned body a great variety of valuable papers. His celebrity, however, is chiefly founded on his *Historia Celestis Britannica*, a work in three volumes folio, which was published by his widow in 1725. See ASTRONOMY, vol. ii. p. 599.

Flamstead is represented by his biographers as of a morose and unsociable disposition, and as having been on bad terms with most of his contemporaries. "From some of his letters," says Dr Thomson, (*History of the Royal Society*, p. 335,) "it even appears that he complained of Sir Isaac Newton as unreasonable in his demands of observations. Dr Halley, in the preface of he *Historia Celestis Britannica*, draws rather an unfavourable picture of the disposition of Flamstead; and I ind, from one of Sir Hans Sloane's MSS. in the Bri-ish Museum, that, in the year 1710, he was expelled he Royal Society, because he refused to pay his annual contribution." (*o*)

FLANDERS, the name of a maritime province in he Netherlands. It was formerly divided into Aus-rian, French, and Dutch Flanders. It now belongs to HOLLAND and FRANCE, which see.

FLAT, in Music, (♭), or flattened intervals, are such s are depressed or lessened a degree of the scale, a hromatic semitone, or FINGER-KEY *Interval* (see that ticle.) As it happens, with the Numerals, 1, I, 2, II, , III, &c. of the diatonic scale, that the *major* and *minor* the same NUMERAL (see that article,) are not at the me invariable distance from each other; so the *flats* the literals, D♭, E♭, F♭, &c. are not at one invaiable distance from their naturals D, E, F, &c. al-ough in tempered scales this is obliged to be the case. r Liston has correctly explained these matters, in his Essay on perfect Intonation;" but it may be proper re to put the student on his guard, against the mis-kes and incongruities of other authors, by enumera-ng their different flats.

FLAT, of Dr *Boyce*, in some parts of his MS. in the rary of the Royal Institution, is = S, or 57 Σ + f + n.

FLAT, *double*, of Liston, is invariably S + *f*, or 83Σ + + 7m.

FLAT, *double*, (♭♭), of Chambers and Overend; some-nes 2 P, or 116 Σ + 2 f + 10 m.; at others, P + S, or 5 Σ + 2 f + 9 m.

FLAT, of *Liston*, to the notes D, G, B, or C, is = S, 47 Σ + f + 4 m; and to the notes E, F, or A, is = 𝒮, 36 Σ + f + 3 m, the second flat of any note being al-ys the reverse of its first one.

FLAT, of *Marsh*, = 𝒮, or 36 Σ + f + 3 m.

FLAT, of *Maxwell*, = S, or 47 Σ + f + 3 m.

FLAT, of *Overend*, (and Dr Callcott, *Mus. Gram.* ed. p. 112), = P, or 58 Σ + f + 5 m; this corre-nds with *perfect* fifths. See the theorems below.

FLAT, of some writers, = L, or 46 Σ + f + 4 m.

FLAT, of *regularly tempered Scales*, is the minor lim- of Dr R. Smith, which, according to Mr Farey's orems, *Phil. Mag.* vol. xxxix. p. 44, is = 58Σ + f + —seven times the temperament of the Vth: Or, 8.7519656Σ + f + 3m + seven-fourths of the tempe-ment of the IIId: Or, = 32.3228500 Σ + f + 2m + en-thirds of the temperament of the VIth.

From hence we see, by way of examples, that in the n-tone system, where the temperament of the IIIrd , the *flat* is = 38.7519656Σ + f + 3m, = P — $1\frac{1}{4}$c:— obtaining the *flat* of the *Isotonic* scale, we may er use the temperament of the Vth, 1.0006552Σ, of IIIrd, 7.0052416Σ, or of the VIth, 8.0058968Σ, and either of the above theorems will give 51.008276Σ + f + 4m, being $\frac{1}{12}$VIII:—and, in the system where the major sixths are *perfect*, the flat is = P — $2\frac{1}{3}$c. (ς)

FLAX. See AGRICULTURE, Vol. I. p. 317.

FLECHIER, ESPRIT, bishop of Nismes, an eminent French ecclesiastic, was born at Pernes, a small town near Carpentras, on the 10th of June 1632, of obscure but respectable parents. He was educated at Tarascon, in a college possessed by the congregation formerly known in France under the name of the *Doctrinaires*, or fathers of the Christian doctrine, of which his maternal uncle was, at that time, general. At the age of fifteen, having finished his studies, he employed himself, for some years, in teaching the *belles lettres*, in the same college. Some time after he repaired to Paris, and having determined to fix his residence in that city, he accepted employment in a parish, and afterwards undertook the education of the son of M. Lefebvre de Caumartin. From this period, his reputation rapidly increased, in consequence of the discourses which he delivered on different festivals of the church; and his celebrity procured him admission into the Academy, in the year 1673. He had the honour of preaching before Louis XIV. on Advent, 1682.

For his preferment, and the many favours he received from the king, Flechier was principally indebted to the active patronage and friendship of the Duke of Montaussier, who had already procured for him two benefices, and the abbacy of St Severin, besides the office of almoner to the dauphiness; when, in the year 1685, he was selected as one of a mission, which was destined to bring back into the bosom of the church, the Protestants of Poitou and Brittany, of which mission Fenelon was the chief. On his return, he was appointed to the bishopric of Lavaur, which he held for two years, and was then translated to the more lucrative see of Nismes. The duties of this charge, however, were much more troublesome than those of the former, on account of the great number of Calvinists who were then in open revolt, or ready to break out, against whom the impolitic and disastrous edict, revoking that of Nantes, was rigorously executed. In this difficult situation, the high character of Flechier became eminently conspicuous. By his mildness, moderation, and persuasive address, he contributed to assuage the sanguinary zeal of the Catholics; his humane virtues conciliated the good will of all parties, and he received unequivocal testimonies of regard even from the Calvinists, amidst the horror and devastation of civil war.

When these troubles were at length appeased, he was enabled to devote himself, without obstruction, to the exercise of a zealous and active benevolence. There was not a single charitable institution at Nismes, which was not either founded by him, or indebted to his liberality for support. His favours were indiscriminately conferred upon unfortunate persons of all descriptions, without regard to religious opinions; and in the disastrous winter of 1709, his charity was only limited by the total expenditure of his funds. When some one, upon that occasion, represented to him the disagreeable consequences which might ensue to himself from such profuse liberality, he answered, "What you say is, perhaps, very true; but are we bishops for nothing?" He was as much the enemy of superstition and fanaticism, as he was zealous for the maintenance of pure religion; and he laboured with ardour and efficacy to reform and instruct his clergy, and to enlighten and relieve the people from that blind ignorance and credulity, which are often abused for the purpose of mislead-

Flechier, Flensbourg.

ing them. The well-known story of the *Nun of Nismes*, which furnished the subject of a drama to an esteemed French author of later times, bears strong testimony to his enlightened humanity, and to the sensibility of his heart.

Amidst the manifold and important duties of his charge, Flechier did not entirely neglect the cultivation of letters, to which he originally owed his celebrity and his elevation. The academy of Nismes, which had been founded before his time, was indebted to him for a new existence, and, among other advantages, for that of being affiliated with the French academy. To the latest period of his life, he enjoyed a vigorous state of health, a blessing which resulted in a great measure from his simple and moderate habits, and the equality of his temper. He died on the 16th of February 1710, at the age of 78.

The moral character of Flechier is sufficiently elucidated by the preceding narrative. As an author, his reputation rests principally on his *Oraisons Funebres*, which, although inferior, perhaps, in point of genius and true eloquence to those of Bossuet, are written with an elegance and brilliancy of expression, and in an affecting strain of Christian piety, which have procured them a considerable portion of admiration, and given them a place among the classical productions of the French divines. His style is remarkably polished; even in his familiar letters, and notes written upon ordinary occasions, his language had a finished correctness, which, in any other person might be taken for the effect of labour and affectation; but which, in him, resulted from a profound study of the delicacies of the French tongue, and a habit which he had acquired of constantly writing with the utmost attention to propriety and elegance of expression. The complete works of Flechier were published at Nismes, in ten volumes 8vo, in 1782. (*z*)

FLENSBOURG is the name of a sea-port town of Denmark, situated on the eastern coast of the duchy of Sleswick, and though not the capital, is the most opulent and important place in the duchy. The streets are rather narrow, and the houses, though not so neat and clean as those of Sleswick, are constructed in a more substantial and durable manner. Like that town, it consists principally of one very long street. The back of this street looks towards the harbour, and on that side each house has a garden, separated from the water by an agreeable promenade. On the right is the harbour, filled with vessels, and on the left are the gardens, each of which has a door opening into the promenade. Kuttner informs us, that the harbour is safe and convenient, and was full of ships when he saw it. It is narrow close to the town, but the whole bay, called Flensbourg Wisk, is 18 miles long, and may be regarded as a harbour, as it has a sufficient depth for large vessels, and is sheltered from every wind by the surrounding hills.

The trade of this town has been very important since the middle of the last century. It is carried on principally with Norway, Denmark, and Sweden, and consists of brandy, grain, skins, provisions, wines, and stuffs. The wines and stuffs are brought from France, England, Spain, and America. The inhabitants trade also with Iceland, Greenland, and Finland. The number of commercial houses is from 120 to 130. The following is a list of the vessels belonging to the town.

	Number of vessels.
1780, ...	134
1783, ...	200
1788, ...	218
1797, ...	257

Fletcher.

In 1797, the number of sailors was 1597. There are no fewer than 200 establishments for manufacturing and distilling brandy, and these have served, at the same time, to fatten 4000 head of cattle, and as many swine. The town also contains five refineries of sugar, 40 manufactories of tobacco, and several tanneries. The position of the town, according to trigonometrical observations, is, East Long. 9° 27′ 40″, and North Lat. 54° 47′ 18″. See Kuttner's *Travels through Denmark, Sweden*, &c. Lett. 1.; and Catteau Calleville, *Tableau de la Mer Baltique*, tom. ii. p. 325. (*w*)

FLETCHER, Andrew, of Salton, in East Lothian, was a statesman and a patriot of the highest order; and though Scotland, his native land, was the chief object of his exertions, yet, wherever the love of country and of liberty prevails, he deserves to be remembered with respect and gratitude. His powers, too, were called forth at a period of the greatest importance in the British annals. His paternal grandfather, whose Christian name he bore, was one of the fifteen Judges of the Court of Session, by the style of Lord Innerpeffer. His father was Sir Robert Fletcher of Salton and Innerpeffer; and his mother, whose name was Catharine, daughter of Sir Robert Bruce of Clackmannan, derived her descent from the royal and truly illustrious race of Bruce. Andrew Fletcher was the eldest son of this marriage, and was born in the year 1653, though in some sketches of his life the date of his birth is stated to be 1650. The celebrated and excellent Gilbert Burnet was but 10 years older than young Fletcher; and, as Sir Robert Fletcher presented him to the rectorship of Salton, which he filled with most exemplary fidelity from 1664 to 1669, Andrew enjoyed the rare advantage of having his principles formed, and his mind cultivated, by Dr Burnet, to whom his father, at his death, wisely consigned the care of his son.

Gifted by nature with uncommon powers, it is not surprising that, under such a preceptor, he made rapid progress in classical knowledge, historical erudition, and general literature. His hereditary love of liberty, connected with his indignation at the tyrannical proceedings which marked the conduct of the administration of Charles the Second after the restoration of that unprincipled king, gave an unfavourable bias to his temper, and seems even to have made him regret that union of the crowns of Scotland and England which was so essentially conducive to the peace and prosperity of both divisions of the island.

Having amply qualified himself, by the deep and solid foundation which had been laid by Burnet and his other instructors, for receiving improvement, by personal observation of men and manners, he travelled for some time on the Continent, and was, soon after his return, elected to represent East Lothian in the Scottish parliament, which consisted only of a single house. While James, Duke of York, acted as lord high commissioner in Scotland, Fletcher distinguished himself in particular by his strenuous opposition to the measures of the court, and particularly to the Bill of Accession. Having connected himself with the Earl of Argyle, he became so obnoxious that he found it necessary to consult his personal safety by leaving Scotland. After remaining for a time in retirement in London, where he had an opportunity of seeing and consulting his friend and former instructor Burnet, now a distinguished preacher, and occasionally a faithful monitor of King Charles, of whose personal and political profligacy he afterwards became the steady opponent, Fletcher by his advice went to Holland, and was soon after declared an outlaw in Scotland, and his estate confiscated. In the United Provinces he and many of the friends of religion and liberty found an asylum.

He returned to England in 1686, with his friend and countryman Robert Baillie of Jerviswood, who, in the following year, died on a scaffold at Edinburgh, for having aided or connived at the expedition under the Duke of Monmouth, and the unfortunate Earl of Argyle. It is recorded to the honour of this virtuous man, that though he was offered his life on condition of revealing what he knew of Fletcher's connection with this fatal enterprise, he nobly rejected the proposal, and died, as he had lived, the friend of religious and civil liberty.

As to Fletcher, it appears that he acted a still more important part on that occasion than his friend; not only being a statesman, but having great knowledge in military affairs, he actually bore arms in that part of the expedition which landed in England, and served under Monmouth; but finding that, contrary to his engagement, that rash leader caused himself to be proclaimed king without the choice and consent of the people, and without any of those wise limitations which Fletcher considered necessary, he quitted his standard, and concealed himself till he found an opportunity of returning to the Continent. It is stated, that while he had the command of a party in this expedition, he killed the mayor of Lynn, in a dispute which arose about a horse belonging to that gentleman, which had been pressed into the service by his troops. It has even been said, that this event rendered him so unpopular in the little army, that it was deemed advisable for him to retire. Fletcher himself, however, complained of the gross injustice which had been done him in the account of that transaction; and, in his own account of his conduct on this occasion, which he afterwards gave to the Earl Mareschal of Scotland, he utterly denied that it had any thing to do with his leaving Monmouth; in proof of which he stated, that he had continued with him till the proclamation above alluded to was made at Taunton, which Fletcher regarding as a violation of the Duke's engagement, and of his duty to the nation, absolved him from all farther engagement to serve under him.

The vessel in which Fletcher made his escape, was bound for Spain. Information having, by some unknown means, reached the English minister at Madrid, of his arrival, he applied to the Spanish government, who caused him to be apprehended and put in prison, in order to his being transmitted to London. But he escaped in a manner so extraordinary, that if it had not formed a part of his account of himself to the Earl Mareschal, it might have been deemed incredible. On the eve of his departure, a stranger of a venerable aspect made signals to him through the bars of his prison. Fletcher, on looking around him, found a door unlocked; and, on going out at it, was joined by his deliverer, who conducted him in silence through three guards of soldiers, who were, or appeared to be, asleep. He was then assisted in escaping from the place, by another person equally unknown. He proceeded through Spain in disguise; and, having credit on a house in Amsterdam, he spent a considerable time in examining the scenery and curiosities of the country, and purchased many curious books, which the Earl of Buchan, in his *Essay on the Life of Fletcher*, informs us are still preserved in the family library at Salton. During his journey he met with several singular and providential deliverances, which he used to recount to his friends with pleasing and pious emotion, regarding them as proofs of the special protection of heaven.

We next find him serving as a volunteer in the Hungarian war under the Duke of Lorrain. Meanwhile he had not been an inattentive observer of the signs of the times in his native land; but, having availed himself of such opportunities as occurred, of learning what was going on at home and in Holland, he gave up his prospects of military fame and promotion, and joined the band of exiles and patriots from Britain, who were preparing at the Hague for the execution of the grand enterprise on which the liberties of his country were suspended. Having declined to accept James the Seventh's act of indemnity, under which several persons of distinction had recovered their estates and honours, he came over with the Prince of Orange in 1688, along with Bishop Burnet, Sir Patrick Hume, &c. The success of this grand effort is detailed in its proper place. At present, we have to do with Fletcher, who, whilst in Holland, asserted the rights and liberties of Scotland previous to the Revolution, against William Prince of Orange, with a firmness and unbending zeal which made him appear as desirous of giving the crown without the sceptre, and prevented him from being a favourite of the prince.

In the Convention Parliament which met in Scotland after the Revolution, he was a strenuous advocate for popular freedom and regal limitations; and it is a circumstance highly honourable to him, that, except regaining possession of his family-estate, which happened as a matter of course, he never seems to have enjoyed or desired any office, emolument, or pension, whatever. "*Non sibi sed patriæ*" was the noble principle on which he acted. King William respected and feared him; but finding him "too fond of the right, to pursue the expedient," did not confide in him.

In Fletcher's Political Works, which were published in one 8vo. volume in 1737, we find seventeen speeches that had been delivered by him in the Scottish parliament, most of them about the year 1703; and all except three on the great questions which then agitated the nation, relative to the settlement of the Scottish crown, in the event of the death of Queen Anne without issue. In these speeches, which are certainly a great historical and literary curiosity, he advocates with great boldness the cause of popular right against royal privilege; laments the degeneracy of the nobility and people from the high spirit of their ancestors, and reproaches them for their servility to England. He brought in and supported a bill entitled "Act for the security of the Kingdom," which, had it passed, would have lodged the whole executive power in the hands of the parliament, and rendered the king a mere puppet to be shewn at a procession. Against this alarming project, the Queen's commissioner exerted all his influence, and even signified that as, without the touch of the royal sceptre officially given to the act, as the Scottish mode of expressing the royal assent, it would not have the force of a law; so that assent must be withheld, even if the scheme should obtain the sanction of parliament. Finding this could not be carried into a law, he formally moved, that "the proposed limitations should be declared by a resolution of the House of Parliament, to be the conditions upon which the nation *will receive* a successor to the crown of this realm, after the decease of her present Majesty, and failing heirs of her body, *in case the said successor shall be also king or queen of England*." (Fletcher's *Political Works*, Speeches No. III. and IV.) Even in the present age of free discussion, we can hardly find an instance of greater boldness than this. From the close of this motion, his dislike to the union of the crowns will be seen, as it evidently implies that if Scotland should choose a separate king, he would not consider so many limitations necessary. Yet even if this latter event had taken place, there is no doubt that Fletcher would have displayed his characteristic jealousy of princes in a manner calculated sufficiently to fetter the power of the crown. He did not hesitate afterwards boldly to assert the constitutional right of the Scottish parliament to separate the crown of Scotland from that of England, at the close of the then existing entail of the crown, and to express his conviction of the necessity of this measure for the welfare of his native land. Happily for Great Britain and the world these projects proved unsuccessful; and we cannot sufficiently wonder, that one so well acquainted with the nature of man, and with the constitutional and political history of the two divisions of the island, should have calmly formed such a design. It seems to us a striking proof of the power of early prejudice over the wisest and best-intentioned minds. Had William and Mary, or their successor Queen Anne, been as bigotted and tyrannical, as they were in truth liberal and tolerant in their domestic and foreign policy, we could with less difficulty have explained the conduct of Fletcher on this occasion.

We regret that none of his speeches on the union of the parliament of Scotland with that of England, which was proposed in the succeeding sessions, and which, after a great deal of angry and dangerous contention, was enacted in 1706, and actually carried into effect in 1707, have been published. His general sentiments on that subject will be found, however, in the very amusing paper usually printed as the last in the volume of his works. It is entitled, "An account of a conversation concerning a right regulation of governments for the common good of mankind, &c. 1703." In the report of the characters and dialogue, he shews considerable dramatic skill; and in his own part of the scene, he displays a degree of politeness and address superior to any thing of this kind to be found in his parliamentary speeches. Though Fletcher did not succeed to the extent that he desired, he laid his country under great obligations, by the modified "Act of Security," which was eventually passed, and by the many wise and salutary provisions which he caused to be connected with the measure. One hundred and eight years have now elapsed since this most important act of union was adopted; and the progressive improvement and happiness of the two countries fully warrant us to consider it as one of the greatest political blessings we enjoy. The gloomy predictions of its enemies have been completely reversed, and greater benefits have resulted from it than the most sanguine could have reasonably anticipated. Several of the principal speeches delivered by the opponents of this union have come down to us, and deserve to be preserved as curious memorials of opinions that have passed away. Of these, perhaps the most eloquent is that of Hamilton, Lord Belhaven, in which, with much poetical pathos, he drew a most affecting picture of its evil consequences. With peculiar and almost prophetic felicity, the Earl of Marchmont replied, "I have heard a long speech, and a very terrible one; but it requires only this short answer, Behold! he dreamed; lo, when he awoke, he found it was a dream."

The Earl of Buchan, who published his brief memoir of Fletcher chiefly on the authority of a manuscript history of the family, gives no account of him beyond the year 1703; and does not even notice the time or manner of his death. We think it extremely probable that he had a seat in the parliament of Great Britain; but that the advanced period of his life, and his dissatisfaction with the union, prevented him from taking a leading part in the deliberations of that assembly. He died in London in the year 1716, at the age of 63. His remains were brought to Scotland, and interred in the family vault at Salton.

As a man, Andrew Fletcher was endowed with high talents, great courage, integrity, generosity, and temperance. On the purity of his intentions as a patriot, the exertions and sufferings of his life form the best commentary. He was a most elegant scholar, and an accomplished orator. His speeches are remarkable for their plainness and energy, and form, by their brevity, a striking contrast to the wordy eloquence of the present day. His "Discourse concerning the affairs of Spain," originally published in the Italian language, but which appeared in an English dress in the 12mo edition printed at Glasgow in 1749, displays an ample and profound acquaintance with the interest, policy, and connections of the continental states, as well as of Great Britain, and shews him to have been deeply acquainted with the doctrine of the balance of power, which has since been the theme of so much discussion, and the cause of so much strife among the philosophers, politicians, and warriors of Europe. His "Discourse on the establishment of a national militia," is learned and ingenious, but too Utopian to admit of a practical application. His "Two Discourses on the affairs of Scotland," contain many curious views of the state of society at the time when they were written. On one topic only, we must offer a few remarks. These Discourses were written in 1693, when, in consequence of some years of barrenness, a scarcity, or rather a famine, existed through the land, and occasioned the most severe sufferings to the lower classes. The author declares, that besides those who were scantily provided for out of the church boxes, there were at the time when he wrote, not less than 200,000 persons in Scotland begging from door to door. "And though," he observes, "the number of them be perhaps double to what it was formerly, by reason of this present distress, yet in all time there have been about 100,000 of those vagabonds, who have lived without any regard either to the laws of the land, or even to those of God and nature." He tells us also, that when he considers the many excellent laws enacted by former parliaments, for setting the poor to work, particularly those made in the reign of James VI. contrasted with their utter inutility; when he considered farther, that all the other nations in Europe, Holland alone excepted, groaned under a similar pressure, he was led to suspect that neither the cause nor the remedy of the evil had been discovered. As no such evil had been complained of by the classical writers of antiquity, and as much poverty was the consequence, in Europe, of the manumission of slaves by their Christian masters, he gravely supposes that the existence of domestic slavery was the cause of the comfort and industry of the lower orders in former times. It will hardly be credited by those who are acquainted with his high notions of political right, and his constant jealousy of the power and ambition of princes, that he proposes reducing all those persons and their posterity to slavery, by a solemn act of the legislature, that on the one hand they might be compelled to work, and on the other might be insured of the necessaries of life. A more extraordinary remedy for a public evil, all circumstances considered, was never surely devised; and though he guards the projected plan against the danger of leading to extreme oppression, by salutary and humane regulations, we may safely say, that a less justifiable or less effectual remedy could hardly have occurred to a thinking mind. The evil has long since disappeared, in consequence, chiefly, perhaps, of the provision for public instruction in the principles of religion and morality, made by an act of the Scottish parliament, two years before Fletcher's discourse was written, viz. in 1696. We regret that the accounts of this excellent man are so meagre and scanty; and we consider a good account of his life and writings as an important desideratum in the literature of our native country. (*l*)

FLINTSHIRE, is a maritime county, and the most northern in North Wales. It consists of a narrow slip of land, that runs from north-west to south-east; and is bounded by the Irish Sea on the north; by the estuary of the Dee, and the county of Chester, on the north-east and east; and by Denbighshire on the south and west. At the distance of some miles from the main body of the county there is a detached portion, separated by the interposition of Denbighshire, and nearly surrounded by Shropshire and Cheshire. This disjoined piece consists of the hundred of Maelor Saesneg. *Maelawr*, in the Welsh language, signifies a place of traffic, mart, or market. There were formerly many districts so denominated, near the marches or boundaries of the principality, which were considered neutral ground, where trade was carried on. This detached portion of Flintshire, therefore, was most probably the neutral ground, on which the English, or Saesneg, as the Welsh even yet stile them, met the latter for the purposes of traffic.

Flintshire, with the exception of the isle of Anglesey, s the smallest of the Welsh counties, the main porion of it being about 28 miles in length, and in no lace above 10 in breadth,—generally much less. Its ircumference is 115 miles. Its area contains 309 square niles, or 197,760 statute acres. It is divided into five undreds, viz. Coleshill, which contains 4 parishes, 3 ownships, and 1 borough; Maelor, the disjoined hunred already mentioned, which contains 5 parishes, 1 xtra parochial place, 9 townships, and 1 chapelry; Iold, which contains 2 parishes, 2 townships, and 1 hapelry: Prestatyn, which contains 4 parishes, and 3 ownships; and Rhyddlan, which contains 8 parishes, township, and the town of Holywell. The number f entire parishes in the county is 16, and there are 9 arts of parishes. It contains one city, St Asaph; one ounty town, Flint; and five market towns. It is in ie province of Canterbury, and the diocese of St Asaph id Chester. It is in the same circuit with the latter ounty; the assizes are held at Mold. It returns two embers to parliament, one for the county, and one for lint; or rather, the right of election is vested in the habitants of the boroughs of Flint, Rhyddlan, Overn Caerwys, and Caergurley, including the inhabinnts of Knolleton and Overton foreign, paying scot id lot, who amount to about 1000 voters. Flintshire ıys one half part of the land-tax.

This county is not nearly so uneven in its surface as any other parts of Wales. The northern extremity, well as the detached part, is mostly a level tract; and e southern portion is agreeably diversified with hill d dale. On the Denbighshire side, the county is backed by a lofty chain of mountains, that overlook the Vale of Clywd; from the banks of the Dee, the land rises rapidly to a ridge of hills, which run for a considerable way parallel to that river. The Vale of Mold, in the southern part of the county, is uncommonly rich and beautiful. The Vale of Clywd, also, partly belongs to Flintshire; the city of St Asaph being situated on the river Clywd, in the centre of it. At this place, the vale is between four and five miles broad.

Flintshire.

Soil.

The low part of Flintshire consists, for the most part, of a clayey or loamy soil: whereas, the soil of the hills is lighter, and much more barren. The rivers are the Dee, Clywd, Wheeler, Sevion, and Allen; but only the last three can properly be described under the head of this county. The Wheeler rises near Caerwys, a market-town near the middle of the county; its course is nearly west, and it falls into the Clywd almost opposite Denbigh. The Sevion rises to the north of Caerwys; its course is also west, and it falls into the Clywd a few miles to the north-west of St Asaph. The Allen rises a few miles to the south of Ruthin, in Denbighshire: at first, its course is to the north; it next winds to the east; and falls into the Dee to the north of Wrexham in Denbighshire. Near the town of Mold, this river sinks under ground, and is lost for a short space.

Rivers.

Climate.

The climate of Flintshire partakes, though not in a very great degree, of the nature of the climate of North Wales; being rather mild near the sea, but wet: the hilly parts are exposed to cold and sharp winds.

Agriculture.

Flintshire presents nothing striking or instructive in an agricultural point of view. On the flat tract, in its northern extremity, a considerable quantity of corn is grown, especially wheat, of which a good deal is exported to Liverpool. In the rest of the low portion of the county, the land is applied to the production of both corn and grass. Flintshire is one of the breeding counties of Wales. The cattle are of the common small black kind, for the most part: formerly the farmers kept a great number of bees, from the honey of which they made metheglin or mead; but this practice is now greatly discontinued. The low part of the county is well-stocked with wood.

Mines.

The importance of Flintshire is derived almost entirely from its mineral productions; of these, the lead mines in the vicinity of Holywell are the most valuable and curious. The entrance to one of the largest is through a water level, cut from the bottom of the lowest shaft: at the extremity of the level is a mill, which is turned by the waste water from the mine. The first 600 yards of the canal are cut through shale and chertz: the remainder, (700 yards), through hard limestone. The veins of this mine are unusually rich, the principal seam being from five to six feet thick. Sixty miners are usually employed in it. The great bank of ore is found about 40 yards from the surface, dipping down gradually almost as low as the level. The ore is chiefly galena; considerable quantities of calamine are also procured. Some kinds of the lead ore contain silver sufficient to repay, with profit, the expence of separating it from the lead; and several thousand ounces of silver have been annually extracted in this county, and sent to the manufactures of Sheffield and Birmingham. The calamine is partly exported, and partly used in the brass works near Holywell. In the south-eastern parts of the county, there are considerable coal mines, from which the city of Chester is in a great measure supplied. Millstones are also found in Flintshire; and some years ago as they were sinking coal pits in the parish of Mold, a sort of black slate was strength is their principal ornament. The walls are thick, and broken by few windows, and these of a very diminutive size, and the whole basement fortified with large unhewn masses of stone. The upper stories are faced with freestone, and the whole is crowned with a very heavy projecting cornice.

Medicean gallery.

In those palaces, which are the property of private persons, there are many pictures and statues by the best masters. Of these, the collections in the Ricardi and Gerini palaces are the most valuable. The Palazzo Vecchio and Pitti, the residences of the grand dukes, and more lately of the king of Etruria, were completely stripped of their pictures and statues by the French, and the only monuments of art that now adorn them are their painted ceilings, which it was impossible for the rapacity of the invaders to remove. But of all the collections of the works of art, no one has acquired so high a reputation as the Medicean gallery. This magnificent building was erected by Cosmo I. in the year 1564; but the greatest part of its contents were collected in the succeeding century by the Cardinal Leopold de Medici, son of Cosmo II. and many additions were made by the princes of Lorraine and Austria. The busts of the Medicean princes and other contributors to the gallery adorn the vestibule, and, like the tutelar deities of the place, seem to claim from the passing traveller the homage due to their munificence. The gallery, or corridor, is in the shape of a Greek Π, of which the two wings are each 430 feet in length, and the intermediate part 97. The paintings and statues in the gallery are arranged in series of Florentine portraits,—of illustrious foreigners—of painters, &c. and, the busts of all the Roman emperors and their families, from Julius Cæsar to Constantine. The corridor is bordered on one side by a suite of halls or cabinets, each of which is consecrated to some set of masterpieces either in sculpture or painting, or collections of antique and modern medals, coins, gems, &c. Of the former, however, many of the most celebrated now grace the galleries of the Louvre, and the hall of the far-famed Venus de Medici is now a temple bereft of its divinity. Of those that remain, the most remarkable is the group of Niobe and her children; it consists of 16 figures, which are generally considered as models of the highest perfection; although it is a subject of debate among critics, whether this group be a copy, or the original, which is ascribed by Pliny the elder to the chissel of Scopas or Praxiteles.

A minute description, however, of this celebrated collection would exceed our limits; and we must refer our readers for this and the account of the natural history museum, to the *Museum Florentinum*, the *Panorama of Florence*, and similar publications.

Population.

In 1782, Florence was calculated to contain about 97,000 inhabitants; if, however, in this, as well as other respects, it has followed the fate of the other Italian cities; the long period of misery and war which has since ensued, must have greatly diminished its population.

Commerce.

As early as the 14th century, while the Venetians and Genoese were contending for superiority in the Levant, Florence had become powerful, and its citizens wealthy, by their attention to commerce. As they were not at that time, however, possessed of a seaport, their care and attention was principally directed to the improvement of their manufactures, and objects of domestic industry. It appears from a contemporary historian, that the silks and cloths of Florence were the chief manufactures in the 14th century. From their connections they acquired in various parts of Europe, and their individual wealth, the Florentines were naturally led to banking, and became in this, as in their zeal for liberty, the successors of the citizens of the free states of Lombardy. And such was the superiority they acquired, that the money trade of almost all the kingdoms of Europe fell into their hands; and in several states, the collection and administration of the public revenues were even confided to their care. The immense fortunes which were acquired in these ways, enabled the Florentines to enter into a still wider range of commercial exertion: and soon after the conquest of Pisa, we find Cosmo de Medici endeavouring to obtain for his countrymen a share in the Indian trade, then carried on by the Genoese and Venetians. In this he succeeded, by concluding a treaty with the Sultan of Egypt, by which they were admitted to an equal share of all the privileges and immunities enjoyed by the Venetians in Alexandria. But the commercial greatness of Florence fled with her liberty, and with her forsook the fertile plains and groves of the Arno, for the less highly favoured vallies of Britain, and the frozen shores of the Baltic.

Manufactures.

The present trade of Florence consists entirely in the sale of the productions of her own territory, and her manufactures, &c. Of the former, the chief are her raw silks, oil, and wines. Of the latter, the most celebrated is the manufacture of silks, which still continue to be esteemed. These are principally taffetas, damasks, and velvets. There are also manufactured stuffs, mixed with gold, and silks, satins, and light stuffs, commonly called Florence taffetas. There are a variety of other manufactures, among which their fine porcelain has attained to high celebrity. The Tuscan porcelain has been introduced with great success into Britain by the late Mr Wedgewood.

History.

It is difficult to ascertain with certainty the precise era of the foundation of Florence. It appears to have been a place used for markets and fairs by the Etruscan inhabitants of the town of Fæsulæ, (now Fiesolé,) whose situation, on one of the rocky eminences that command the Valdarno, was ill adapted for such purposes; and the first houses in Florence were the booths erected for the accommodation of traders. Under the government of Sylla, it became the seat of a Roman colony. The walls of the new city were first traced out by that dictator, and it is supposed to have acquired its name from the officer who had the charge of the settlement of the infant colony.

We find but little mention of it in history during the period that elapsed from the time of Sylla, till the later ages of the Roman empire. But there can be no doubt, that, from the beauty of its situation, and its convenience for inland commerce, it must have greatly increased in population and riches. At the time that it was almost entirely destroyed by Totila, king of the Goths, during his war with the generals of the Emperor Justinian, Florence abounded in baths, theatres and aqueducts, a sure indication of the wealth and luxury of its inhabitants.

During the iron sway of the Lombards in Italy it continued in ruin and obscurity until the end of the eighth century, when it was rebuilt by Charlemagne, after that monarch had completely annihilated the Lombard government.

Under the feeble princes of the Carlovingian family, during the anarchy of the reigns of the dukes of Friuli, and the other petty sovereigns, who successively assumed the title of king of Italy, and the subsequent disputes between the German emperors and the bishops of Rome, Florence, like the other cities of Tuscany and Lombardy, was gradually acquiring strength along with the spirit of liberty and independence.

Exposed to sudden assaults of hordes of Saracens, Bulgarians, and other barbarous nations, against whom heir powerless lords were unable to assist them, the irst step towards freedom was the right granted them f surrounding their city with walls and fortifications. t was not, however, until the reign of Otho I. about he middle of the tenth century, that the people were llowed to elect magistrates for themselves, and esta- lish a regular municipal government. The constitu- ion adopted by the Florentines, was a deliberative ouncil, or senate of 100 persons; and, for the execu- on of justice, consuls who were chosen from among he most respectable class of citizens. Of these there ere originally four, elected by the four quarters of the ty. When it was increased to six divisions, two new nsuls were also added, who were elected in the same anner.

In the year 1207, the consuls were deprived of the ght of judging in civil cases, and of pronouncing and ecuting criminal sentences, and these duties were as- gned to a magistrate styled a *Podesta*. It was enact- , that this person should be a foreigner, that no citi- n might draw upon himself odium, by the execution public justice; while, on the other hand, he might t be deterred by motives of fear, or family partiali- s, from doing what was necessary for the public fety.

Although the Florentine government appears to have casionally taken part in the quarrels between the perors and the popes, and especially in that of Otho . and Innocent III. yet the internal peace of the te remained undisturbed. It was not until the year 15, that a private quarrel having on a sudden kind- the spirit of party, the Florentines were engaged in ivil war, which, after continuing for 33 years with ious success, at length terminated in the banishment the Guelph or Papal party, and forced the republic take a decided part in the wars of Italy. Notwith- nding these long continued dissensions, the republic ms not to have suffered either in point of popula- n or wealth. The annalists of that period talk of the essary enlargement of the city, of the erection of lic buildings, of the fortification of castles, with many er signs of its increase in strength and riches. It , indeed, exclusively to such national purposes that Florentines applied the fruits of their industry. ir manners and mode of living were simple to a de- , and all personal pomp and luxury were strictly essed by sumptuary laws.

he power of the Ghibelline, or imperial faction, was of short duration in Florence. The citizens, ha- ed by the tyranny of the nobles, suddenly took up s in the year 1250, and having deposed the Podesta, erred his authority on an officer styled the captain e people, to whom they appointed as a council, 12 istrates called Auziani, two of whom were chosen ach quarter of the city. To this council they gave ame of the Seigniory, and each of its members was main no longer in office than two months. The esses of the nobles were demolished, and the mate- employed in repairing the walls of the city; and a ic palace was built for the accommodation of the bers of government. On the death of the Empe- rederic II. in 1251, the people seized the oppor- y of recalling the banished faction of the Guelphs, and having forced the chiefs of both parties to sign a treaty of peace: they added to the captain of the people a Podesta of a Guelph family in Milan.

No sooner was the popular government established in Florence, than the citizens, animated by the strength they had acquired, endeavoured to bring over the whole of Tuscany to their party. For an account, however, of the wars that ensued, and the subsequent history of Florence, as connected with foreign transactions, we refer our readers to the article ITALY, confining ourselves at present to a brief sketch of the internal revolutions of the republic.

In the year 1258, the Ghibellines attempting to regain their ancient ascendancy, were, in their turn, expelled from Florence, and obliged to take refuge in Sienna. By that republic they were not only received but protected, notwithstanding the threats and declaration of war by the Florentine Signory. The Ghibellines soon acquired a still more powerful protector, Manfred, king of Sicily, who, at the solicitation of Farinata des Uberti, sent to their aid a small body of German cavalry. On the total defeat of these by the Florentines, Manfred, irritated at the disgrace, resolved to take a more active part in the war, and immediately sent 800 cavalry, besides infantry, into the state of Sienna, under the command of Giordano d'Anglone. Alarmed at this new addition of strength to their enemies, the heads of the Guelphs hesitated to attack them in the Sienese territory. But the people, partly influenced by their distrust of the nobles, and partly by the intrigues of two of the Ansiani, whom Uberti had gained over by bribery, insisted on invading Sienna. The Florentine army accordingly took the field, consisting of 3000 cavalry and 30,000 infantry, and a battle was fought on the 4th September, 1260, at Monte Aperto, on the banks of the Arbia, where the Guelphs were completely defeated, with the loss of 10,000 killed, besides an immense number of prisoners. The consequence of this defeat was a second expulsion of the principal Guelphs, who, with their families, were, by the orders of the people, exiled from Florence, nine days after the battle.

At a diet of the Ghibelline states of Tuscany, it was seriously proposed to destroy completely the city of Florence, whose growing power and inclination to the opposite faction rendered it so dangerous to its neighbours; and this proposal meeting with approbation from the Tuscan deputies, was nearly agreed on, had not the firmness and eloquence of Farinata des Uberti, whose abilities so much contributed to the victory, been successful in altering the opinions of the diet, and preserving the independence of his country. For six years the Ghibellines retained the sovereignty, by the assistance of a garrison of the king of Sicily's soldiers commanded by Count Guido Novella. The spirit of the people, however, was hostile, and the tyrannical administration of Guido did not diminish their attachment to the pontifical faction.

The defeat of Manfred at Grandella by Charles of Anjou, and his subsequent death, raised the spirits of the exiles; and Count Guido, alarmed by an insurrection of the people, having deserted his post, the Guelphs, aided by 800 French under the command of Guy de Montfort, (son of the celebrated Earl of Leicester), re-entered Florence on Easter day 1267, and again expelled their ancient antagonists. Their whole property was immediately conficated, and, after the loss sustained by the Guelphs was repaired, thrown into a fund, under the administration of particular magis-

Florence.

trates, destined to provide for the constant maintenance and increase of the Guelph party. At this period, also, an important addition was made to the Florentine constitution of four new councils, without the co-operation of which, the signory could not determine on any point of importance. The first in order was the "Council of the People," consisting of an hundred citizens. Next, but on the same day, the council "De Credenza" was consulted; this consisted of 80 members, and in it the heads of the seven principal trades had a right to a seat. From both these councils, the watchful jealousy of the people excluded all nobles and Ghibellines. On the following day, the business was considered by the council of the Podesta and the general council, the former composed of 90 members, indiscriminately chosen from the nobles and plebeians, besides the heads of the trades, and the latter of 300 citizens of all denominations. The establishment of these tended greatly to increase the influence of the people. The number of citizens composing them, and their continuing in office only one year, prevented them from having any peculiar interests independent of their constituents; while the check they afforded on the magistracy was immediate and powerful.

In the year 1279, by the zealous and active interposition of the Cardinal Latino, legate and nephew to Pope Nicolas III. a peace was concluded between the Guelphs and Ghibellines; to the latter were restored their fortunes and estates, and the right of participation in the public offices. At the same time, the pious endeavours of the Cardinal were successful in putting an end to a family feud between the Adimari and Donati, in which a considerable portion of the people had participated.

In 1282, the Florentines adopted a new system of government, which continued until the downfal of the republic. This was a new signory, consisting of six members, who were styled priors of the arts and of liberty; one being chosen from each of the incorporated professions, except that of the judges and notaries. These continued in office only two months; and, during that time, resided in the public palace, which they were not allowed to quit. The council of election consisted of the signory going out of office, with the heads and councils of the principal professions, and certain others chosen by them from the different quarters of the city. No person could be re-elected in less than two years, and a subsequent law excluded all nobles or gentlemen, although nominally members of the corporation, from being ever elected priors. This, and the other laws, tending to destroy the power of the nobles, were called the *Ordinamenti della Giustizia*, and were introduced by Giano della Bella, who, though a noble, had more regard for the general liberties of his country, than the peculiar interests of his order.

It was not the destiny of Florence to continue long in a state of tranquillity. New factions arose in a few years, and the Guelphs, divided into the two opposite parties of the Bianchi and Neri, combated among themselves with as much fury as when opposed to their former political antagonists. These wars were carried on with various success, until the Neri, assisted by Charles of Valois, succeeded in expelling the Bianchi, who were thus forced to join with the Ghibellines, their brethren in exile.

The expedition of the emperor Henry of Luxemburg into Italy in 1310, revived the drooping spirits of the imperial faction, while, from the distinguished part Florence held among his opponents, it gave to that republic a much higher place in the scale of the Italian states than it had hitherto held. In fact, after this period, the history of Florence is so much involved in that of the revolutions of Italy, that it becomes impossible even to narrate the changes of its internal policy, without entering largely into the general history of the times; and we must therefore close this article by again referring our readers to the articles Italy, Tuscany, Medici, &c. (E. J.)

Florida.

FLORIDA, a province in North America, is bounded on the north by Georgia; on the east, by the Atlantic; on the south, by the gulf of Mexico; and on the west, by the Mississippi. It extends between 500 and 600 miles, from east to west; and little more than 100 from north to south, except at its eastern peninsula, where the breadth is nearly 400 miles. It is situated between 25° and 31° of North Latitude, and between 80° and 92° of West Longitude. This country was first visited in 1497, by Sebastian Cabot, a Venetian mariner in the service of Henry VII. of England; but was more completely discovered by Juan Ponce de Leon, a native of Spain, in 1512. This navigator giving credit to an old tradition, that a fountain existed on the American continent, which had the property of bestowing perpetual youth, fitted out a small squadron, and bent his course towards the quarter where these precious waters were supposed to be concealed. Discovering land on Easter day, he gave it the name of Florida, from the Spanish name of that festival; *Pasqua de Flores*; or, according to Herrera, from the appearance of the country, which was covered with flowers, and the most beautiful blossoms. He landed on the coast; and, taking possession of the soil in name of his Catholic Majesty, he erected a stone with an inscription, commemorating his visit. But, having been prevented by the opposition of the natives from effecting a settlement, and, being disappointed in the chief object of his expedition, he returned to Puerto Rico. Another voyage was undertaken, in 1528, by Pamphilo de Narvaez, who sailed with 400 men from the island of Cuba; and, attempting to penetrate into the interior of the country, was never more heard of. At length, in the year 1539, it was entirely subdued by Ferdinand de Soto, one of the bravest officers in the Spanish service; but it cost the Spaniards a long and bloody struggle before they were able to establish themselves in the country.

History.

In 1564, the French began to form some small settlements on the coast; but they made little improvement of the natural advantages which the country presented, and devoted their whole attention to hunting and warlike excursions. The Spaniards, in the meantime, sent a fleet against their colony, and put all the settlers to the sword. A Frenchman, named De Gourges, made severe reprisals in 1597, demolishing the forts erected by the Spaniards, and murdering all the colonists whom he found in the country. From this period the French neglected America, and the Spaniards continued to make petty establishments on the coasts of Florida.

In 1586, their principal fort, St Augustine, was attacked by Sir Francis Drake, who reduced and pillaged the place; and, in 1665, it was entered and plundered by Captain Davis, at the head of a body of Buccaneers. In 1702, Colonel More, Governor of Carolina, attempting to annex the country to the British

History. dominions, marched a corps of 500 English and 700 Indians to the walls of St Augustine, and besieged it for the space of three months; but the Spaniards, having sent a squadron to the relief of the garrison, he raised the siege, and made a precipitate retreat, just when he was on the point of accomplishing his enterprize. When a British colony was settled in Georgia, in 1733, the Spaniards became very apprehensive of a new attempt upon Florida; and, in 1740, an expedition was fitted out against St Augustine by General Oglethorpe. But the Spanish commander having received intelligence of the intended attack, made such additions to the strength of the garrison, and adopted such skilful measures of defence, that the English were compelled, after sustaining considerable loss, to abandon their design. In 1763, Florida was ceded to Great Britain, in exchange for the Havannah, which had been taken from Spain; and, by the encouragement given to agriculture by its new masters, numbers of colonists poured into the country from the neighbouring provinces, the British isles, and all the Protestant nations of Europe. In the year 1781, it was again recovered by the Spaniards, and was guaranteed to them by the treaty of peace in 1783. In their possession it has remained from that period, and forms one of the three governments which compose the captainship-general of the island of Cuba. In 1810, a revolution took place in West Florida, disclaiming the authority of Spain; but the leaders were divided in opinion, whether they should maintain their independence as a separate state, or accede to the American confederation. They sent agents to Washington, who had an interview with the President of the United States; and, in the mean time, the American government have been prosecuting a claim upon the province since the year 1804, and in 1811 took measures for occupying the western division. This claim arose out of a dispute respecting the boundaries of Louisiana, which Spain had ceded to France in 1801, and which the latter power sold soon after to the United States, for the sum of fifteen millions of dollars. It is contended by the American government, that West Florida forms a part of Louisiana, which they purchased from France; and, on the ground of certain spoliations, alleged to have been committed by Spain on American commerce, they have advanced pretensions upon East Florida also, by way of indemnification. These pretensions have been supported by actual invasion; and there being little probability of a restoration or a re-conquest, the whole province may now be considered as included in the territory of the United States.

East Florida consists of a large peninsula, and a tract of land, extending from the mouth of the river St Mary westward, to the river Appalachicola. It lies between 30° 50′ and 25° North Latitude, and between 80° and 85° West Longitude, extending from east to west from 100 to 190 miles, and from north to south from 100 to 400. West Florida lies between 67° and 73° West Longitude, and extends along the north coast of the Mexican Gulf, upwards of 300 miles from the river Appalachicola to the lakes Ponchartrain and Maurepas; thence along the river Ibberville to the Mississippi; and thence to the 31° North Latitude, from which a line drawn eastward to the river Appalachichola, forms its northern boundary. The sea coast of both provinces is low, and the country continues very flat for more than 40 miles inland, when it becomes a little hilly, interspersed with rocks. Towards the west, the rise is more gradual, and the surface more woody. The coast is deeply indented with small gulfs and inlets, and intersected with numerous rivers. **Islands.** Along the south coast are several islands, which are included in the province, but which are of little importance or utility. The most remarkable are Cat Island, eight miles east of St Louis Bay, above six miles in length, and bordered with immense quantities of shells; Ship Island, about ten miles south of Biloxy Bay, nine miles long, and two broad; Horn Island, about six miles farther east, very narrow, and about seventeen miles in length; Massacre Island, two miles east of the last mentioned, also very narrow, but nearly nine miles long; Dauphin Island, five miles farther east, six miles in length, and about two in breadth; Rose Island, a long and narrow sandy slip parallel to the coast, between Rose Bay and that of Pensacola; and the Tortugas, about ten in number, nearly opposite the most southern point of East Florida, covered with mangrove bushes, and extending ten or eleven miles from north-east to south-west. Some of these islands are mere sand, and none of them produce any thing better than grass and pines. The principal island in the east coast is Anastasia, opposite to the town of St Augustine, divided from the mainland by a narrow channel, and twenty-five miles in length.

Rivers. The rivers, which empty themselves into the Atlantic ocean, are St Mary's, the common boundary between Florida and Georgia, about a mile broad at its mouth; St John's river, rising in a marshy tract near the middle of the peninsula, and flowing gently northward, traverses several lakes, (the lowest of which, Lake George, is 20 miles long and 12 broad,) and falls into the sea about 40 miles south of the St Mary; and Indian river, which runs from north to south, and falls into the sea about 60 miles south of Cape Cannaveral. Most of the rivers which fall into the Gulf of Mexico, have their source in the province of Georgia, and the most worthy of notice are the Appalachicola, which divides East from West Florida, and is composed of two streams, the Flint and the Chatohuthe, arising in the Apalachian mountains, and uniting on the confines of Florida; the Escambia, the source of which is unknown to Europeans, and which empties itself into the bay of Pensacola; the Perdido, formerly the boundary between Louisiana and Florida, and falling into the sea four leagues west of Pensacola Bay; the Mobile, which has its source in the country of the Chickasaws, and, for 40 leagues of its course, is called the Tombeche, and which, after receiving the Alibama, becomes navigable nearly 120 miles from its mouth; the Pascagoula, which is navigable upwards of 150 miles, and which falls into the gulf about 16 miles west from Mobile Bay; the Pearl River, which originates in the Chaclaw territories, and is also navigable upwards of 150 miles; and the Regolets, which is worthy of notice, chiefly as issuing from lake Ponchartrain, which is 40 miles long and 24 broad.

Towns. St Augustine, the capital of East Florida, and originally founded by the Spaniards, about the year 1580, stands in 29° 45′ North Lat. on the coast of the Atlantic. It is built at the neck of a peninsula, in an oblong form, and consists of four principal streets, which cut each other at right angles. It is fortified with bastions, and surrounded by a ditch, and is also defended by a castle called Fort St John, well provided with ordinance. The river St Mark flows through the harbour, and separates the town from the island Anastasia. The north and south breakers, at the entrance, form two channels, whose bars have eight feet of water. Pensacola, the capital of West Florida, was regularly laid out by the English in 1765; and is about a mile in length, of an oblong form, lying nearly parallel to the beach, and defended by a fort, which was built also by the English in 1775. In consequence of a low and sandy shore, only small vessels are able to approach the town; but the bay affords a commodious harbour to the largest ships, which may ride there in perfect security from every wind. Mobile, situated at the mouth of the river of that name, on a gently rising bank, is nearly a mile in length, and contains several good houses, which are chiefly built of brick, with a regular fortress also of brick, towards the lower end of the town. There are, besides, numerous forts and settlements, generally in the neighbourhood of Indian villages. The houses of Europeans are usually of brick, consisting only of one story, but built on an extensive scale, having generally three sides inclosing a large square area. The more ordinary habitations are formed of a strong cypress frame, which is filled with brick, and then plastered white, inside and out; or sometimes lathed, and then covered with a reddish well-tempered mortar, which gives them the appearance of brick walls.

General aspect and soil.

The country of Florida, in its general aspect, is flat, sandy, and barren, on the sea shore; but upon advancing inland, it becomes very marshy, abounding in natural meadows. Thence it presents a rich and fertile appearance, especially on the banks of the rivers; and, for the space of 30 or 40 miles from the coast, there is scarcely to be seen a single stone weighing more than two or three pounds. The interior parts are more hilly, and covered with wood; but the surface is more stony, and the smaller size of the trees indicates a decreasing fertility in the soil. The soil is commonly a white sand, lying on a bed of white clay; in some places a dark grey, brown, or black loam, on a foundation of whitish marl, chalk, and testaceous limestone: in the plains of West Florida, the vegetable mould is often perfectly black, soapy, and rich, lying on a deep bed of chalk or shells.

Climate.

The climate is various, and has been distinguished into two tracts, viz. the northern, which includes the continental and western part of Florida, and the southern, which comprehends almost the whole of the peninsula. In the latter district, the thermometer stands habitually, in summer, between 84° and 88° of Fahrenheit, in the shade; and, during the months of July and August, frequently rises to 94°. In all seasons, the sun is scorching hot at noon; and, in winter, it very rarely freezes, nor is the cold ever so severe as to injure even the China orange tree, the fruit of which is said to be there remarkably delicious. The air is pure and free from fogs, but the dews are generally excessive. In January, the weather is wet and stormy; in February and March, dry and clear; in July and August, thick, hot, and suffocating; but, from the end of September to the end of June, it is altogether inconceivably delightful; and then, says Volney, "there is not, perhaps, a finer climate in the world." The east side of the peninsula is hotter than the west; and, towards the southern point of the west coast, there are, from May to August, frequent squalls and tornadoes, but not of long continuance. On the east, or Atlantic side, the eastern trade wind prevails; but, on the west, or towards the Gulf of Mexico, there are cooling sea breezes from the north-west, through the whole season of summer. About the autumnal equinox, and during the two or three months following, violent storms and dreadful hurricanes frequently occur. In the northern climate, the winds are colder and more variable, the frosts in winter more severe, the temperature more changeable, and the fogs more prevalent, so as to occasion mouldiness, rust, and the deliquescence of salt, sugar, &c.; yet the town of St Augustine, where this dampness is very great, but where there are no adjoining marshes, is the healthiest place throughout these latitudes; and many persons from the Havannah resort thither, as to a Montpelier. In both the tracts of climate, however, particularly in the more northern, there are great variations from heat to cold, making often a change of 30° upon the thermometer, in the space of twelve hours.

Diseases.

From the end of June to the middle of October, the season of the heavy rains, combined with violent heats, fevers are very common, and are observed to be most obstinate near the rice and indigo plantations. Persons who drink hard, and sleep in the open air, are very subject to tetanus; and all intemperate habits are found to be utterly ruinous to health in these provinces.

Vegetable productions.

The vegetable productions of Florida are particularly deserving of notice, both for their wonderful variety and luxuriant growth. Nothing can exceed the majestic appearace of its towering forest trees, and the brilliant colours of its flowering shrubs.

Trees.

The pines, palms, cedars, and chesnuts, grow to an extraordinary height and size. The laurels, especially the magnolias, are uncommonly striking objects, rising with erect trunks to the height of 100 feet, forming, towards the head, a perfect cone, and having their dark green foliage silvered over with large milk white flowers, frequently eight or nine inches in diameter. The live oaks, after forming a trunk from ten to twenty feet high, and from twelve to eighteen in circumference, spread their branches fully fifty paces on every side. The cypress, generally growing in watery places, has large roots like buttresses, rising around its lower extremity, then rearing a stem of eighty or ninety feet, throws out a flat horizontal top like an umbrella, so that often growing in forests all of an equal height, they present the appearance of a green canopy supported upon columns in the air. The dog-wood trees rise to the height of twelve feet, then spread their branches horizontally, which, meeting and interweaving with others on every side, form a shady grove, so dense and humid, as completely to exclude the rays of the sun, and to suppress the growth of any other vegetable, thus presenting to the traveller a natural shelter, frequently extending for the space of ten miles without interruption. But the most beautiful of the forest tribe, is the tapering carica papaya, which rises to the height of twenty feet, with a stem perfectly straight, smooth, and silver-coloured, having a spherical top of leaves always green, and ornamented at once with flowers and fruits.

Fruits.

Many rich fruits, particularly limes, prunes, peaches, and figs, grow wild in the forests, and grapes, vines, whose stems are often ten or twelve inches in diameter, climb around the trunks of the trees to their very tops, but those which produce the best fruit creep along close to the ground from one low shrub to another.

Shrubs.

Among the shrubs may be particularly mentioned a species of myrica, called the wax tree, which grows to the height of nine or ten feet, and produces a number of large round berries, covered with a coat of white wax, which is formed by the inhabitants into candles, harder and more lasting than those made of bees wax. Of the numerous flowering plants, we can only particularize a species of hybiscus, which, though a herbaceous plant, renewing its stem every year, yet grows to the height of ten or twelve feet, branching regularly in the form of a sharp cone, and is covered with hundreds of large expanded crimson flowers, which blow in succession during the whole of the summer and autumn months. That singular vegetable production, generally called the long moss, which is found in most countries within the tropics, is remarkably prevalent in the woods of Florida. It grows from the limbs and twigs of all the trees, and pushing out on all sides its pendant branches, sometimes fills up, as with a curtain, the spaces between the arms of large trees, and, at other times, waves from the lower limbs like streams, to the length of fifteen or twenty feet. Wherever any part of it fixes upon the bark, it presently takes root as readily as if it had sprung from the seed. When fresh, it is eaten by the cattle and deer in the winter season; and when properly dried, it is found to answer better than any other substance for stuffing matrasses, chairs, saddles, &c. When steeped, dried, and beaten like hemp, it leaves a hard, black, elastic filament resembling horse hair, which the Spaniards in South America work into cables, that are said to be very strong and durable. In the marshes and banks of the lakes and rivers, the reeds and rushes grow to an extraordinary size, some of the former being actually 30 or 40 feet high, and being used as masts to the canoes; but among the aquatic plants, the *Pistia stratiotes* is particularly worthy of notice. It resembles a well-grown stock of garden lettuce, and vegetates from seed on the surface of stagnant water; but, associating in large quantities, it forms floating islands, which, though first produced close to the shore, are sometimes carried by the wind or current into the river, where they are nourished by long fibrous roots descending to the muddy bottom; and then extend themselves like a green plain, several miles in length, and a quarter of a mile in breadth, furnishing a habitation to crocodiles, frogs, otters, herons, curlews, &c.

iculu- produce. The principal vegetable productions regularly cultivated for the subsistence of the inhabitants, are corn, pulse, particularly beans, potatoes, pompions, melons, rice, and a variety of esculent roots, particularly a species of arum, which is much cultivated in the maritime districts, and has a large turnip-like root, resembling when boiled or roasted the taste of the yam. Tobacco, cotton, and indigo, are raised in considerable quantities; and the last mentioned article, made in East Florida, is accounted equal to the best Spanish produce. Among the mineral productions of this province are found several kinds of precious stones, amethysts, turquoises, and lapis lazuli. Ochre, pit-coal, and especially rich iron ore, are very abundant. Near to New Smyrna, a thriving settlement on the Musquito river, is a vast hot mineral spring, issuing from a high ridge on the bank of the river, with great force, and in such abundance as to fill a circular bason, capacious enough for several shallops to ride in it. The water is of a sulphureous nature, and covers every inanimate substance deposited in it, with a pale bluish coagulum; but it is remarkably diaphanous, and the numerous fishes, which subsist in this tepid stream, are seen at a considerable depth with the greatest distinctness.

rals.

s. The country is stored with creatures fit for the use of man, without producing many that are very formidable, either from their ferocity or strength. There are rabbits, squirrels of several species, (some of which are remarkably beautiful), racoons and opossums, which are accounted very delicious food; herds of deer and horned cattle, which are large and fat, but subject to extensive ulcerations in their thighs and haunches, supposed to be occasioned by their standing during the heats of summer, in the lakes and rivers, feeding on the water-grass; and horses, running wild, as well as kept in herds by the natives. They are extremely beautiful and sprightly; but of a small breed, and almost as slender in their form as the American roe-buck. Of the wilder tribes, there are the weasel, polecat, and lynx, which last is a very fierce little creature, preying upon young pigs, fawns and turkeys; foxes, of the small red species, which bark during the night, but move so precipitately, that they are seldom heard twice in the same spot; wolves of different colours, larger than a dog, generally assembling in companies, particularly during the night-time; bears, in considerable numbers, and of great strength, but scarcely ever known to attack human beings. When fat and full grown, they weigh from 500 to 600 pounds weight; and their flesh is greatly esteemed as food by the natives. Of birds, besides many which are migratory, there are found stationary in Florida, vultures, hawks, rooks, jays, parrots, wood-peckers, pigeons, turkeys, herons, cranes, curlews, cormorants, pelicans, plovers, &c. A few of the more remarkable are the *snake bird*, a species of cormorant of great beauty, which delight to sit in peaceable communities, on the dry limbs of trees, hanging over the lakes, with their wings and tail expanded, as if cooling themselves in the air; and, when alarmed, they drop as if dead into the water, suddenly appearing again on the surface, at a great distance from the spot where they first sunk, but shewing only their long slender head and neck above the water, which gives them very much the appearance of a snake. The *crying bird*, a species of pelican, about the size of a large domestic hen, and of a speckled colour, with a short tail, having the longest feather in the middle, and the two outermost perfectly white, which the bird is accustomed, whenever he is disturbed, to flirt out on each side with the quickness of lightning, uttering at the same time a very harsh and loud shriek. The *wood pelican*, a large bird, nearly three feet high when standing erect, feeding on serpents, frogs, and other reptiles, is generally seen solitary on the banks of the marshes and rivers, with his neck drawn in upon his shoulders, and his long crooked beak resting like a scythe upon his breast; this bird is supposed to approach the nearest to the Egyptian ibis. The *painted vulture*, of a white or cream colour, except the quill feathers of the wings, and the tip of the large tail feathers, which are of a dark brown or black, is seldom seen, unless when the deserts are set on fire, which sometimes happens from lightning, and is more regularly done by the Indians, to rouse the game; and then they gather from every quarter towards the burning plains, and alighting among the smoking embers, gorge their immense craws with roasted serpents, frogs, and lizards. The Creeks form their national standard with the tail-feathers of this bird, preserving them in their natural white colour, in peaceable negociations, but drawing a zone of red beneath the brown tips when they go to battle. The *great savannah crane*, a very stately bird, about six feet in length from the toes to the extremity of the beak when extended, nearly five feet when standing erect, and eight or nine feet between the extremities of the expanded wings: they fly in detached squadrons, all rising and falling as one bird, and while they move their wings in flight with slow and regular strokes, the shafts and webs of their quill-feathers may be heard at a considerable distance in the air, creaking like the working of a vessel in a tempestuous sea.

Birds.

Fish.

The coasts, sounds, and inlets, abound in excellent fish; and the inland lakes and rivers are, in some places, actually crowded with the finny tribe. Of these, the more remarkable are, the great brown spotted *garr*, from five to six feet in length when fully grown, whose impenetrable skin resembles a coat of mail, of which the scales are so sharp and strong, that the Indians use them as points to their arrows. The *mud fish*, about two feet long, the flesh of which is white and tender, but rather soft, and not much esteemed. The *golden bream*, or *sun-fish*, about eight inches in length, resembling the trout in shape, remarkably strong and rapacious for his size, and very delicious as food; the silver or white bream, and the black or blue bream, which are also extremely beautiful and abundant; the cat-fish, sting-ray, scale, flounder, spotted bass, sheeps-head, drum, &c. and many other varieties, are found every where, even in the smaller ponds and open holes, in the utmost abundance.

Amphibia.

This multitude of fishes furnishes subsistence to an equally numerous brood of alligators, which are seen in all the rivers and lakes, in immense bodies, many of them more than 20 feet in length. A prodigious assemblage of them in the river St John, was witnessed by Mr Bartram pursuing the vast shoals of fish with which that river abounds; and his description of the scene will best convey an idea of their numbers, as well as of the prolific nature of the waters in Florida. "The river in this place from shore to shore, and perhaps near half a mile above and below me, appeared to be one solid bank of fish of various kinds, pushing through this narrow pass of St John's into the little lake, on their return down the river; and the alligators were in such incredible numbers, and so close together from shore to shore, that it would have been easy to have walked across on their heads, had the animals been harmless. What expressions can sufficiently declare the shocking scene that for some minutes continued, whilst this mighty army of fish were forcing the pass! During this attempt, thousands, I may say hundreds of thousands of them, were caught and swallowed by the devouring alligators. I have seen an alligator take up out of the water several great fish at a time, and just squeeze them betwixt his jaws, while the tails of the great trout flapped about his eyes and lips ere he had swallowed them. The horrid noise of their closing jaws, their plunging amidst the broken banks of fish, and rising with their prey some feet upright above the water, the floods of water and blood rushing out of their mouths, and the clouds of vapour issuing from their wide nostrils, were truly frightful." Here may be mentioned, as belonging to the same genus with the alligator, the lizards of Florida, of which there are several species: the little green chamelion, about seven inches long, and very harmless; the striped lizard, called scorpions by the Americans, covered with small scales, vibrating their tail, and darting out their forked tongue when pursuing their prey; a small blue lizard, remarkably swift, with a long slender tail, which is subject to be broken off like that of the glass snake. There are several kinds of tortoises in the rivers and lakes, of which the most deserving of notice is the great *soft shelled tortoise*, some of which, when full grown, weigh from 30 to 40 pounds, extremely fat and delicious, and resembling very much in form and appearance the sea turtle. The whole back shell, except the vertebra and ribs, is cartilaginous, and easily reduced to a jelly when boiled. These creatures bury themselves in the slushy bottoms of rivers and ponds, under the roots of aquatic plants, leaving an aperture just sufficient for the head to play through, for the purpose of seizing their prey, which they do with great rapidity, and frequently drag even the young water fowl from the surface. There is also the great *land tortoise*, called gopher, found only on the dry sand hills, of a light clay colour, and not easily distinguished from a stone. The upper shell, about 18 inches long and 12 broad, is exceedingly hard; and the animal on level ground, can easily carry a man standing on its back.

Of *frogs* there are various kinds, the largest of which is about 8 or 9 inches in length from the nose to the extremity of the toes, and has a loud hideous voice, inferior indeed to the bull frog of Virginia, but greatly resembling the grunt of a hog. Of the smaller kind, there are the *bell frog*, the voice of which is similar to the sound of a cow bell; another species of a beautiful green colour, which utter a noise like the yelping of young dogs; a still smaller tribe which infest the houses, whose voice is like that of young chickens; and an extremely diminutive class, called Savanna crickets, which may be seen in the rainy season clambering like spiders upon the tall grass. There are red and black *toads*, the former of which are very large, weighing upwards of a pound, but no way venomous.

Reptiles.

There are numerous kinds of snakes in Florida, but little different from those which are found in the other southern provinces of the United States. The largest is the *rattle-snake*, which is commonly from four to six feet in length, and sometimes even eight or ten. With a single scratch of one of his fangs, he is able to kill the largest animal, but is never known to strike unless first assaulted; nor can he creep faster than a man may walk, and may easily be killed with a single blow on the head or back, from a stick not thicker than a man's thumb. There are also the *moccasin snake*, which abounds in East Florida, large as the rattle-snake, and said to be more formidable by being more apt to bite; the bastard, or *ground rattle-snake*, of small size, but extremely fierce and venomous; the *green snake*, a beautiful and harmless creature, about two or three feet in length, but not thicker than a man's little finger; the *ribband snake*, of a clear vermilion colour, variegated with transverse zones of dark brown, very inoffensive, and generally found about old buildings; the *chicken snake*, very strong and swift, about six feet in length, but scarcely so thick as a man's wrist, a domestic kind of creature, innocent as a worm, easily tamed, and capable of being made useful for destroying rats, but apt at the same time to prey upon chickens; the *bull snake*, as long as the rattle-snake, uttering when irritated a loud hissing noise, but completely inoffensive with respect to mankind; the *coach-whip snake*, a beautiful and harmless creature, about six feet in length, but slender as a common walking stick, and tapering from the abdomen towards the tail like a switch, or long whip, remarkably swift, seeming at times to fly along the surface of the ground, touching it only with its lower extremity; the *glass snake*, of a bluish green colour, about two feet and a half in length, with a short belly, and great length of tail, which is so extremely fragile, that it breaks like glass by a gentle stroke of a light switch.

Insects.

Incredible numbers of the small insects called ephemera, cover the surface of the lakes and rivers, supplying abundant food for the birds, frogs, and fishes; and clouds of beautiful butterflies hover among the shrubs and flowers. Various flies of a more hostile character, harass the traveller and his horse in the hotter seasons; and particularly one species called the *burning* *fly*, of a splendid green colour, and golden head, which stings like the prick of a red hot needle, or a spark of fire on the skin. *Gnats* and *musquitoes* also are extremely frequent and troublesome, especially on the sea coast, and in the rice and indigo plantations; but they are said to disappear in proportion as the land is cultivated. There are said to be no *bees* in West Florida; but in the east province they are sufficiently numerous.

Population. When Florida came into the possession of Great Britain, the greatest encouragement was given to settlers; and at first considerable additions were made to its European inhabitants. But their increase was extremely slow, notwithstanding the salubrity of the climate, and the advantages offered by government to the planters; and, since the country was recovered by the Spaniards, its population and improvement are very imperfectly known. The whole of the white population is calculated by Volney not to exceed 40,000; and the amount of the Indian tribes residing within its territories cannot be ascertained with any degree of accuracy. ndian ibes. Parties of the Chactaws and Chicasaws are occasionally seen in the more western districts, between the river Mobile and the Mississippi; but the more regular occupants of the interior are the Muskogees or Muscogulges, generally called the Confederated Creeks, on account of the rivulets and swamps with which their territory abounds. Their principal settlements are situated between the branches of the river Mobile and those of the Appalachicola, particularly on the borders of the Coussa and Falpoose. These are generally distinguished by the name of Upper Creeks; and, in 1771, were supposed to number 3500 warriors; but, as their country is connected rather with the province of GEORGIA, we have already referred to that article for a fuller account of their character and manners. That part of the same nation who inhabit the Floridas, are called the Lower Creeks, or Siminoles. Directing their course to the south in quest of a more plentiful country, they completely extirpated the Yamasees, who were then in possession of these fruitful regions, and in close alliance with the Spaniards, and now form one people with the remains of the tribes who were in alliance with the conquered race. There are found, particularly in East Florida, numerous monuments of apparent antiquity, with the nature of which none of the present Indians seem to have much acquaintance; and which, therefore, render it highly probable that the country was formerly occupied by a people more civilized and skilled in the arts of life than the Yamasees, Creeks, or any of the modern American tribes, known to Europeans. These are pyramidal hills or artificial mounts, erected near the sites of ancient towns, so as to command an extensive prospect of the adjacent country, and conjectured to have been intended as watch towers, or places for sacrifice; vast tetragon terraces adjoining to these mounts, supposed to have been the foundations of fortresses; oblong sunken areas surrounded by a bank, sometimes by two, one behind the other, more elevated than the first, resembling amphitheatres for the exhibitions of games or shows, and generally appropriated by the modern Indians to the execution of their captives; artificial lakes or ponds, to which spacious avenues run from the mounts. These ancient remains were seen by Bartram on the east shore of St John's River, at the entrance of the great Lake George, on the opposite shore, on the bank of the Little Lake, on Dunn's Island, a little below Charlotteville, and on the west banks of the Musquitoe River, near New Smyrna. The Siminoles, who now inhabit these countries, are a mere handful of people, and range at liberty over the richest plains of both provinces. They find, in the spontaneous productions of the soil, and in the abundance of game which the forests afford, a superfluity of subsistence; and secured in the midst of their swamps from any sudden attack of hostile tribes, they have nothing to occasion their disquietude, but the gradual encroachments of the White people. They are remarkably joyous and volatile in their dispositions; and nothing can be more expressive of lightness of heart than their whole visage, deportment, and motions. They are fond of gambling, and spirituous liquors; and amuse themselves, like children, in endeavouring, by the most extravagant stories, to excite surprise and laughter. They are the most active and expert hunters, and by the sale of deer, bear, tiger, and wolf-skins, honey, wax, horses, &c. they procure their clothing and domestic utensils from the White settlers. They are, however, treacherous and unsteady, and being far removed from the controul of the upper Creeks, with whom they are confederated, and whose government is more regular, they are apt to pay little regard to treaties of amity with the Whites, and to commit murders and depredations on detached families who fall into their hands. See *Modern Univ. Hist.* vol. xxxix.; Robertson's *Hist. of America*, vol. ii.; Bartram's *Travels in Carolina, Georgia, and Florida*; Volney's *Account of the United States*; Bernard Romans *Concise Natural and Moral Hist. of East and West Florida*, published at New York in 1776, a very scarce but highly interesting production; and Hutchin's *American Geography*. (q)

FLORIS, FLORES, or ENDE, is the name of a large island in the eastern seas, situated to the east of Java, between the 120th and 123d degrees of East Longitude, and the 8th and 9th degrees of South Latitude. It is about 200 miles long, and has an average breadth of 36 miles. The interior of this island is very imperfectly known. The inland parts are mountainous and woody, and it contains a burning mountain of considerable height. Towards the sea coast, the country is fine and open. The principal place frequented by the English in passing through the straits of Floris, is the village of Larantouca, upon the island of Floris. Refreshments for two or three ships can be obtained here, such as goats, hogs, fowls, and fruits, buffaloes, and some turtle, and water. In return for these, the natives will receive gun-powder, musket balls, glass bottles, wine glasses, white linen cloth, and all kinds of coarse cutlery. Benzoin, ambergris, and small quantities of wax, are exported from the island, and sandal wood in small quantities may also be obtained. Many of the natives profess Christianity, and they generally hoist the Portuguese flag. The Burman language prevails over the greatest part of the island. The Portuguese visited this island at a very early period, and gave it the name of Floris; but there is no reason to believe that they ever established a regular settlement. See Milburn's *Oriental Commerce*, vol. ii. p. 385; and Hamilton's *East India Gazetteer*. (w)

FLUENTS. See FLUXIONS.

FLUIDS. See CHEMISTRY and HYDRODYNAMICS.

FLUSHING, VLISSENGEN, or FLESSINGUE, is the name of a seaport town of Holland, situated in the island of Walcheren, on the north side of a branch of the river Scheldt. The port lies between two moles, that break the waves of the sea, which enters the town by means of two canals, forming two basons. This town defends the passage of the Scheldt and of all the islands of Zealand. The Stadthouse, which is built in

Flute, Flutter.

imitation of that of Amsterdam, is a magnificent building. The position of the town, according to trigonometrical observations, is 3° 34′ 57″ West Long. and North Lat. 51° 26′ 42″. See WALCHEREN.

FLUTE STOP, in Music, is a range of pipes in an organ, so called, because the tone of them resembles the English flute or flagiolet. Their pitch is an octave higher than the diapasons, or in unison with the principal stop, but whose sounds are less soft and pleasing than those of the flute stop. (ε)

FLUTTER, in Music, is a phenomenon attending the sounding of a regular discord, made by two notes that are diatonically related otherwise than as a concord, as $\frac{8}{9}$, $\frac{9}{10}$, $\frac{5}{9}$, $\frac{9}{16}$, $\frac{15}{16}$, &c. Before the completion of the Rev. Mr Liston's EUHARMONIC *Organ*, (see that article,) it was very difficult to so exactly adjust or tune discordant intervals, that this peculiar effect, very different from the beats accompanying imperfect concords, could be heard; and Dr Robert Smith, who gave them this name, was perhaps the first person who experimented on, and investigated the theory of, these fluttering roughnesses of the discords when truly tuned. See his *Harmonics*, Second Edit. p. 97. (ε)

FLUXIONS.

History.

THE invention of the *Method of Fluxions*, as it is called in this country, or the *Differential* and *Integral Calculus*, as it is called by foreign mathematicians, goes no further back than the 17th century; but the inquiries which have led to it, must have occurred to Geometers from the earliest period at which the science of geometry was cultivated. It appears from the writings of Euclid and Archimedes, that when the ancients considered curvilineal spaces, or the solids formed by the rotation of curves, they established the truth of their propositions by a peculiar mode of demonstration, which was indirect, and more subtile and prolix than was used in ordinary cases. The second proposition of the xii. book of Euclid's Elements, is an instance of this kind of demonstration. It is there proposed to prove, that circles have to each other the ratio of the squares of their diameters. The preceding proposition proves, that similar polygons inscribed in the circles, have to each other that ratio; and hence, by a mode of reasoning rather artificial, although quite accurate, the truth of the proposition is proved to extend to the circles themselves, by shewing, that the square of the one diameter cannot be to the square of the other diameter, as the one circle to a space either less, or greater than the other circle.

Although the ancients chose this mode of demonstrating the truth of such propositions, yet it may well be supposed, that they discovered them at first by a more simple mode of reasoning. In the instance we have quoted, as the ratio of similar polygons inscribed in the circles is altogether independent of the number of sides; and as the greater the number of sides, the polygons became more nearly equal to the circles, from which at last they may differ by less than any assignable quantity, it is easy thence to infer the truth of the proposition. Here, however, there is a transition from a polygon of a finite number of sides to the circle, which is tacitly regarded as a polygon of an infinite number of sides: now this is the very circumstance, which in the end led to the invention of the method of fluxions.

When, after a long period of darkness, the light of science again shone forth in Europe, and the writings of Euclid and Archimedes were studied, with a view to detect the principles which had led to the discovery of the truths which they contain, it was soon observed, that these Geometers had been more careful to convince, than enlighten their cotemporaries; and that however well the synthetic mode of demonstration was adapted, to place the truth of a proposition beyond doubt, yet it afforded little aid as an instrument of discovery. It was no doubt this view of the ancient geometry that induced Cavalerius to depart from its rigour, and invent his *Method of Indivisibles*, in which he considered lines as composed of an infinite number of points; surfaces as composed of an infinite number of lines; and solids as made up of an infinite number of surfaces. He appears to have possessed his theory in the year 1629, and he published it in 1635 with this title, *Geometria indivisibilium continuorum novâ quâdam ratione promota*. The accuracy of his method was attacked by Guildinus in 1640, and then he shewed, that at bottom it was the ancient theory of *Exhaustions*, but divested of its prolixity. In fact, these surfaces and lines, of which Cavalerius considered the ratios and the sums, are no other than the little solids, or the inscribed and circumscribed parallelograms of Archimedes, so numerous, as to differ from the figure, which is included between them, by less than any given quantity; but while Archimedes, when he demonstrates the ratio of a curvilineal figure to another known one, employs many words, and an indirect turn of demonstration; the modern geometer, launching as it were into infinity, lays hold in imagination of the last term of these continued divisions and subdivisions, which should in the end annihilate the difference between the circumscribing and inscribed figures, and the curvilineal figure which they limit.

Cavalerius.

Roberval, in France, opened to himself the same career of discovery as Cavalerius had done in Italy. He began by studying the writings of Archimedes; and his method of resolving problems, relating to curvilineal areas, differs from that of Cavalerius, only in its terms. His ambition to obtain a triumph over his rivals, induced him to conceal his discoveries, until he was anticipated by Cavalerius' book, and thus justly punished for his selfishness. He found a method of determining the tangents of curves, which, however, was inferior to another discovered by Descartes: Roberval's method, in many cases, only substitutes one difficulty for another, but Descartes applies to all algebraic curves, and in every case accomplishes the desired purpose.

Roberval.

The obligations which philosophy and mathematics lie under to Descartes, have been generally acknowledged; but there is a feature in his character which gives him a higher claim than any other geometer of his time to the gratitude of posterity, and that is, his eagerness to disseminate the knowledge of science, as well as to extend its boundaries. Instead of hoarding his discoveries, or concealing their source, as others had done by tedious synthetic demonstrations in the man-

Descartes.

ner of the ancients, he gave them with that clearness and simplicity which ought always to characterize the style of works on science.

Fermat. Fermat possessed earlier than Descartes a method of tangents. But he only published it after Descartes had made his known, and he joined to it a method *de maximis et minimis*. These are more simple than Descartes' methods, but their author, far from imitating the frankness of this philosopher, only in a manner indicated them, concealing, at least in the case of the method *de maximis et minimis*, his analysis, and the mode of demonstration. By a multitude of discoveries, several of which, relative to numbers, have exercised the most celebrated analysts of this and the preceding age, Fermat gave proofs of a great genius. He has been considered as equal to Descartes, but the latter philosopher probably contributed more to the propagation of science, by his communicative character, and the simple manner in which he has presented his researches.

lusius. Huygens first demonstrated Fermat's two rules. Slussius afterwards found a simple method of drawing tangents, which at bottom was but the enunciation of the calculus required by Fermat's method; but disengaged from whatever was useless: and lastly, Barrow contrived his characteristic triangle, which in fact is the same as the triangle that measures the fluxions of the abscissa, the ordinate, and curve; and thus the method of finding the tangents of algebraic curves attained its last degree of simplicity.

egory de Vincent. While these improvements in the theory of tangents were going on, Gregory de S. Vincent, Roberval, and Pascal, made some progress towards a general solution of the problem of quadratures. This, however, was done by the method of the ancients, and that of indivisibles, and so does not bear directly on the history of the fluxional calculus, if we except the consideration of polygons of *scales* of Gregory de S. Vincent, or of a series of rectangles inscribed in, and circumscribed about a curve, which may have suggested the application of the fluxional calculus to quadratures.

llis. It is in the arithmetic of infinites of Wallis, that we see the first application of algebraic calculation to quadratures, and this was founded on the method of indivisibles. Wallis considered series, and sought to express their sum by their first and last terms. He thus succeeded in finding the sum when the number of terms was infinite, and the last term may be reckoned as nothing. Considering, then, surfaces as formed of a series of lines, the terms of which follow a certain law, he found the expression for the surface by summing the series. The area of a triangle, for example, was determined by summing an arithmetical progression.

Wallis demonstrated, by his method, the fundamental rule for the quadrature of curves, the ordinate of which is proportional to any power whatever of the abscissa. This enabled him to square any curve, having its ordinate expressed by a series of monomials. His method of interpolation, by which the area of a curve was found, when its equation was in a manner comprehended between the equations of two other curves, to which his first method was applicable, deserves particular attention, because it was the germ of Newton's most beautiful discoveries, and is at present the most important part of the theory of series. This method led him to a remarkable expression for the area of a circle. Wallis must be allowed to have contributed greatly to the progress of analysis, both by his own discoveries, and his having introduced the doctrine of series, which led to all the great discoveries of that period.

Van-Heuraet. Brouncker. Neil and Van-Heuraet gave the first example of a curve that may be rectified, (one of the cubic parabolas.) Van-Heuraet's method reduced the problem of *rectifications* to that of *quadratures*. Brouncker and Mercator, proceeding in the path of Wallis' discoveries, found the first series known for the rectification of the circle, and hyperbola. Brouncker also first noticed continued fractions; and he shewed that the fundamental principle employed by Neil in the rectification of curves, and that by which Mercator squared the hyperbola, were to be found in the works of Wallis.

Mercator. Newton. Mercator published his *Logarithmotechnia* in September 1668, which contained his quadrature of the hyperbola; and soon after the book came out, Mr Collins, secretary to the Royal Society, sent a copy to Barrow, at Cambridge, who put it into the hands of Sir Isaac, then Mr Newton, and a fellow of Trinity College. Presently afterwards, viz. in July 1669, Barrow wrote to Collins, that a friend of his (Newton,) who had an excellent genius to these things, had brought him some papers, wherein he had set down methods of calculating the dimensions of magnitudes, like that of Mr Mercator for the hyperbola, but very general; as also of resolving equations: Barrow afterwards sent these papers to Collins, saying, that he presumed he would be much pleased with them, and requesting him to shew them to Lord Brouncker. Their title was *De analysi per æquationes numero terminorum infinitas*. In this manuscript, the method of fluxions was first indicated, and rules deduced from it given for the quadrature of curves, to which it was observed, their rectification, and the determination of the quantity and the superficies of solids, and of the centre of gravity, may be all reduced: moreover, the author there asserted, that he knew no problems relating to the quadrature or rectification of curves, to which his method would not apply; and that by means of it, he could draw tangents to mechanical curves; so, there can be no doubt but that then, Newton possessed the method of fluxions, and therefore he must be reckoned the *first inventor*. Indeed it appears that although his discovery was promulgated there for the first time, he had been in possession of it from about the year 1666, which was two years before Mercator published his quadrature of the hyperbola. And although the MS. memoir *De analysi per æquationes*, &c. professes to explain the method briefly, rather than to demonstrate it accurately, yet there was enough to shew, that the author was aware of its great importance as an instrument of investigation, and that he had reduced it in some measure to the form of an analytical theory.

Barrow, Collins, and Oldenburg, (another Secretary to the Royal Society,) disseminated the analytical discoveries of Newton by their correspondence, and communicated them to several geometers on the continent, such as Slussius, and Borelli.

Leibnitz. In the year 1672, the celebrated Leibnitz, who afterwards also claimed the honour of the discovery of the method of fluxions, appeared for the first time upon the scene. Happening to be in London, he communicated to some members of the Royal Society, certain researches relating to the differences of numbers; but he was given to understand, that this subject had been already treated by Mouton, an astronomer of Lyons: upon this, he turned his attention to the doctrine of infinite series, which, at that time, engaged all the mathematicians; and, in 1674, he announced to Oldenburg, that he possessed important theorems relative to the quadrature of the circle by series; and that he had very general analytic methods. Oldenburg, in answer, intimated to him, that Gregory and Newton had also found methods, which gave the quadrature of curves, whether they were geometrical or mechanical, and which extended to the circle.

Leibnitz.

The first direct communication which Newton had with Leibnitz, was in 1676. On the 13th June, in that year, Newton sent a letter to Oldenburg, which was to be shewn to Leibnitz: This contained his celebrated binomial theorem, which he appears to have known in 1669; and a variety of other matters relating to infinite series, and quadratures, but nothing directly relating to the theory of fluxions: and it is worthy of remark, that in this letter, Newton speaks of Leibnitz with great respect; so that the suspicion which afterwards arose in his mind, that Leibnitz was not dealing fairly with him in respect of his discoveries, does not appear to have then existed. In a second letter from Newton to Oldenburg, to be also communicated to Leibnitz, he still speaks of his rival with respect; and he here, in compliance with a wish expressed by Leibnitz, explains the manner in which he found the binomial theorem. He also describes the properties of his method of fluxions, as well for the determination of tangents, as the quadrature of curves; but he conceals it under an anagram of transposed letters. Here we have positive evidence that Newton was now in possession of his calculus.

On the 21st June 1677, Leibnitz sent to Oldenburg, to be communicated to Newton, a letter containing the first attempts at a method which applied to every thing that could be done by that of Newton. This was his *Differential Calculus.* The death of Oldenburg, which soon followed, put an end to this epistolary correspondence; and seven years afterwards, viz. in 1684, Leibnitz published his method in the Leipsic Acts for October of that year, with this title, "*Nova Methodus pro maximis et minimis, itemque tangentibus, quæ nec fractas, nec irrationales quantitates moratur et singulare pro illis calculus genus.*" Thus, in whatever way Leibnitz came by his calculus; whether he found it by the power of his own genius, which was certainly very great, or availed himself of Newton's discovery, which had in some measure transpired by his manuscript memoir, "*De analysi per equationes numero terminorum infinitas,*" having been made known to many mathematicians, although not printed; certain it is, that his method was first given to the world; for Newton's method of fluxions only became generally known by the publication of his *Principia,* in the end of the year 1686.

Leibnitz enjoyed, without contradiction, the honour of being the inventor of his calculus, until the year 1699; and even Newton himself, in the first edition of his *Principia,* where he had occasion to give an example of his method of fluxions, allowed to Leibnitz the merit of his invention: For he says, "In the course of a correspondence, which ten years ago I carried on with the very learned geometrician Mr Leibnitz, having intimated to him that I possessed a method of determining *maxima* and *minima,* of drawing tangents, and resolving such problems, not only when the equations are rational, but also when they are irrational; and having concealed this method by transposing the letters of the following sentence, *An equation being given, containing any number of flowing quantities, to find their fluxions, and the contrary,* this celebrated man answered, that he had found a similar method, which he communicated to me; and which differed from mine only in the enunciation, and in the notation." To this, in the edition of 1714, was added, "and in the manner of conceiving the quantities to be generated."

Contest between Newton and Leibnitz.

It has been supposed that the claim of Leibnitz to the discovery would not have been called in question, if he had been just towards Newton: but in this respect he failed, and hence the origin of that quarrel which was carried on with such animosity between the British and foreign mathematicians. In some letters which he had written to persons in Britain, he had appeared to attribute to himself too exclusively the invention of his calculus, and this drew upon him some pointed remarks, respecting the prior claims of Newton. At length, a mathematician named Fatio de Duillier, who is said to have entertained a dislike to Leibnitz, on account of his having omitted to name him in an enumeration which he made of eminent mathematicians, asserted, in a short tract on the curve of swiftest descent, and the solid of least resistance, that Newton was the first inventor of the new calculus, and that he would leave to others to decide what Leibnitz, the second inventor, might have borrowed from the English geometer. To this attack Leibnitz gave a spirited answer, and complained to the Royal Society; and there the dispute rested for a time. Afterwards, when Newton's treatise on the *Quadrature of Curves,* and his *Enumeration of lines of the third order,* came out, in 1704, the Leipsic journalists gave an unfavourable account of it, and in effect said, that Newton had taken his method from that of Leibnitz, substituting fluxions for differences. This assertion called forth the indignation of the British mathematicians, and without doubt offended Newton himself. Accordingly, in 1708, Keill inserted in the Philosophical Transactions a paper, in which he stated formally, that Newton was the first inventor of the Fluxional Calculus, and that Leibnitz, in publishing it in the Leipsic Acts, had only changed the name and the notation.

Leibnitz thus accused of plagiarism, addressed a letter to Hans Sloane, Secretary to the Royal Society, requiring that Keill should retract what he had said: But far from this, Keill replied in a long letter to Hans Sloane, in which he enumerated the reasons that led him to conclude, not only that Newton had preceded Leibnitz in the discovery, but that he had given so many indications of his method, as to bring it within the comprehension of a man of even moderate capacity. This letter was sent to Leibnitz; who requested that the Royal Society should put a stop to the clamour of a person who was too young to know what had passed between him and Newton. The Royal Society judged that it would be proper to consult the original papers, and appointed a committee to select and examine them. The papers which they selected, were published by command of the Society, with this title, *Commercium Epistolicum de varia re Mathematica inter Celeberrimos præsentis seculi Mathematicos,* &c. And to this was added the report of the committee, which was to the following effect: "That Mr Leibnitz was in London in 1673, and went thence to Paris, where he kept a correspondence with Mr Collins, by means of Mr Oldenburg, till about September 1676, and then returned by London and Amsterdam to Hanover, and that Mr Collins was very free in communicating to able mathematicians what he had received from Newton: That it did not appear that Mr Leibnitz knew any thing of the differential calculus, before his letter of the 21st of June 1677; which was a year after a copy

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Contest between Leibnitz and Newton.

of Newton's letter of the 10th December 1672 had been sent to Paris, to be communicated to him; and about four years after, Mr Collins began to communicate that letter to his correspondents, in which letter, the method of fluxions was sufficiently described to any intelligent person: That Newton was in possession of his calculus before the year 1669; and that those who had reputed Leibnitz the first inventor, knew little or nothing of his correspondence with Mr Collins and Mr Oldenburg long before, nor of Newton's having that method above fifteen years before Mr Leibnitz began to publish it in the Leipsic Acts: That for these reasons, they reckoned Newton the first inventor, and were of opinion that Mr Keill, in asserting the same, had been in nowise injurious to Mr Leibnitz.

In this report, the committee cautiously avoided giving any direct opinion upon the only point on which there could be any doubt, namely, whether Leibnitz had invented the calculus for himself, or had availed himself of the labours of Newton. The tenour of their report seems to shew, that they were of the latter opinion. The *Commercium Epistolicum* was circulated with great care over Europe, with a view to vindicate the claim of the British nation, to the most important discovery that has ever been made in abstract science.

It was not to be supposed that Leibnitz would quietly submit to this decision, so unfavourable to his pretensions: He considered himself as grievously injured, and threatened to answer it in such a manner, as to confound his adversaries. This feeling must have arisen from the insinuation, that he had stolen the invention; for, as to the right to priority of discovery, that is, beyond doubt, in favour of Newton.

When this dispute was originally agitated, the natural feelings of patriotism, which protect nations against the encroachments and unjust pretensions of each other, prevented that cool discussion which is necessary for the discovery of truth. The British mathematicians were decidedly adverse to Leibnitz's claims, while the foreigners, on the contrary, supported them with as much acrimony as if it had been a dispute about a matter of faith rather than of testimony. Even Newton himself, who, for a time, does not appear to have taken an active part in the controversy, at last suppressed, in the edition of his *Principia*, printed in 1726, the passage he had inserted in the first edition, which admitted that Leibnitz had discovered the calculus by his own efforts. He probably would have done this in the earlier edition of 1713, if it had not been brought out in a private manner by Cotes and Bentley at Cambridge, while he was at a distance, with whose conduct, on this occasion, he was by no means pleased. It may be supposed, that, in suppressing the passage, he was actuated by a feeling of resentment for the undeserved abuse that had been bestowed on his writings by the friends of Leibnitz, and also by the unjustifiable conduct of that philosopher himself.

It is perhaps impossible now to determine with certainty, whether there were just grounds for the suspicion that Leibnitz had availed himself of Newton's invention. Montucla, in his *History of Mathematics*, vol. ii. p. 381, 2d edit. says, "There are only three places of the *Commercium Epistolicum*, which treat of fluxions in so clear a way as to prove that Newton had found it before Leibnitz, but too obscurely it seems to take from the latter the merit of the discovery. One of these is in a letter to Oldenburg, who had signified to Newton that Slusius and Gregory had each found a very simple way of drawing tangents. Newton replied, that he conjectured what the nature of that method was; and he gave an example of it, which shews that he was in possession of a method in effect the same as these two geometers had found. He adds, that this is only a particular case, or rather a corollary to a method much more general, which, without a laborious calculation, applies to the finding of tangents to all sorts of curves, geometrical or mechanical, and that without being obliged to free the equation from radicals. He repeats the same thing, without explaining himself farther, in another letter; and he conceals the principle of the method under transposed letters. The only place where Newton has allowed any thing of his method to transpire, is in his *Analysis per æquationes numero terminorum infinitas*. He here discloses, in a very concise and obscure manner, his method of fluxions; but there is no certainty that Leibnitz saw this essay. His opponents have never asserted, that it was communicated to him by letter; and they have gone no farther than to suspect that he had obtained a knowledge of it in his intercourse with Collins upon his second journey to London. Indeed, this suspicion is not entirely destitute of probability; for Leibnitz admitted, that, in this interview, he saw a part of the *Epistolary Correspondence* of Collins. However, I think it would be rash to pronounce upon this circumstance. If Leibnitz had confined himself to a few essays of his new calculus, there might have been some ground for that suspicion. But the numerous pieces he inserted in the Leipsic Acts, prove the calculus to have received such improvements from him, that probably he owed the invention to his genius, and to the efforts he made to discover a method that had put Newton in possession of so many beautiful truths. This is so much the more likely, as from the method of tangents discovered by Dr Barrow, the transition to the differential calculus was easy, nor was the step too great for such a genius as that with which Leibnitz appears to have been endowed." In this opinion, we are disposed to agree with Montucla; and we consider that we add to its weight by the following testimony in its favour, from one of the most elegant writers and able critics of the present time: The celebrated La Place having asserted, in his *Philosophical Essay on Probabilities*, that *Fermat was the true inventor of the Differential Calculus*; the writer to whom we have alluded, in a review of La Place's work, says, "Against the affirmation that Fermat is the real inventor of the differential calculus, we must enter a strong and solemn protestation. The age in which that discovery was made has been unanimous in ascribing the honour of it either to Newton or Leibnitz; or, as seems to us much the fairest and most probable opinion, to both, that is, to each independently of the other, the priority in respect of time being somewhat on the side of the English mathematician. The writers of the history of the mathematical sciences have given their suffrages to the same effect. Montucla, for instance, who has treated the subject with great impartiality, and Bossut, with no prejudice certainly in favour of the English philosopher. In the great controversy to which this invention gave rise, all the claims were likely to be well considered; and the ultimate and fair decision in which all sides seem to have acquiesced, is that which has been just mentioned. It ought to be on good grounds, that a decision passed by such competent judges, and that has been now in force for a hundred years, should all at once be reversed." *Edinburgh Review*, vol. xxiii. p. 324.

History.
Contest between Leibnitz and Newton.

The new calculus was not at first cultivated with that attention which its importance deserved; and, therefore, in order to rouse the attention of mathematicians, Leibnitz, in 1687, proposed the following problem: "To determine the curve a heavy body ought to describe, in order to descend equally in equal times." Huygens was the first that shewed what was the nature of the curve, but he did not indicate his method of solution. James Bernoulli also resolved the problem by the differential calculus, and published his analysis in the Leipsic Acts of 1690.

Labours of the Bernoullis.

About the same time, John Bernoulli, a younger brother of James, began his career as a mathematician: he studied the science, aided by his brother's instructions, and he contracted a friendship for Leibnitz, which continued until the death of the latter, in 1716. He made the calculus known in France, and gave lessons on the subject to the Marquis de l'Hopital. Leibnitz and the Bernoullis resolved many new and difficult problems, which they proposed as challenges to the geometers of that period. They also determined the nature of the *catenaria*, (or curve formed by a chain or cord which hangs freely, but is fastened at its extremities), and the curve of swiftest descent, which had proved too difficult for Galileo, and the mathematical theories known in his time. A spirit of rivalship was excited between the two Bernoullis, and they waged a war of problems, each endeavouring to puzzle the other; this, although carried on with a degree of animosity on the part of John not at all becoming, was yet of advantage to the science, as it produced the celebrated *isoperimetrical problems*, a class more difficult than any that had previously engaged the attention of mathematicians; although, indeed, Newton had resolved a problem of this kind in his *Principia*, when treating of the solid of least resistance. The calculus went on, improving continually; it was applied to the theory of *evolutes*, one of the most beautiful discoveries made by Huygens; but, with the exception of some pieces in the Leipsic Acts, there was as yet no work professedly on the subject; at length,

L'Hopital.

the Marquis de l'Hopital published his *Analyse des infiment petits*, in 1699. John Bernoulli claimed the invention of the principal methods in this work, confidentially to Leibnitz in l'Hopital's lifetime, and publicly after his death. Indeed, L'Hopital acknowledges in the preface his obligations to the two Bernoullis and Leibnitz, allowing them to claim as much of it as they pleased, and professing that he would be content with the remainder. L'Hôpital's book treats only of one part of the theory, viz. the differential calculus, which answers to the direct method of fluxions. He says he had intended to give a work on the integral calculus; that is, the inverse method of fluxions; but Leibnitz had informed him, that he was then preparing a treatise *De Scientia infiniti*, which he did not wish to anticipate. This work, however, never appeared. The first general theory in this part of the subject related to the integration of rational fractions, which John Bernoulli gave in 1702: but, indeed, he had indicated the method of integrating differential equations, by separating the variable quantities as far back as 1694.

Manfredi.

In 1707, Gabriel Manfredi, an Italian, gave an entire work, entitled, *De Constructione æquationum differentialium primi gradus*, which contained all that had been done down to that time relating to the integral calculus.

John Bernoulli.

John Bernoulli composed a series of lectures on the integral calculus, for the use of his scholar and patron, L'Hôpital; this was when he came to Paris in the year 1692. These are curious, as the earliest essays in this branch of the calculus, and valuable by their intrinsic merit. They would have formed an excellent sequel to L'Hôpital's work, but they were not published until 1742, when they appeared in the third volume of Bernoulli's works.

Gregory. Craig.

It is to be regretted that Newton did not accomplish a design he had formed in 1671, of publishing his method of fluxions, and its application; for, with the exception of what he himself had done, hardly any thing appeared in England on the subject before the end of the century. David Gregory explained some of its principles and applications, in a treatise, *De dimensione figurarum*, printed in 1684. John Craig published a treatise, *De curvarum quadraturis*, in 1693, which he afterwards enlarged and published again in 1718, with the title *De calculo fluentium*. De Moivre and Fatio gave solutions in the Philosophical Transactions of the problem concerning the *solid of least resistance*; the latter in 1695, and the former in 1699.

Cheyne. Hayes.

In the year 1703, George Cheyne, a Scottish mathematician and physician, published his *Methodus Fluxionum inversa*, Edin. 1703. The author committed some mistakes which were pointed out by De Moivre: He had also been wanting in justice to the mathematicians on the continent, and this exposed him to the animadversions of John Bernoulli. In the year 1704, a treatise of fluxions was published by Charles Hayes Gent. This, we believe, was the earliest work on the subject that was written in the English language.

Newton.

It is remarkable that Newton himself should have been so slow in publishing any thing relating to his calculus. The year 1699 must be considered as the epoch at which his numerous analytical inventions were first made generally known; but this was in the second volume of the works of Wallis. At length, however, in the year 1704, when he printed his *Optics*, he added to it, *Tractatus de Quadratura Curvarum*, in which he explains the principles of his method, applying it to quadratures. Besides, he composed the work he had originally intended, *On the method of Fluxions and Infinite Series, with its application to the Geometry of Curve Lines*. It was written in Latin, and Dr Pemberton once intended to have published it, with the author's consent, in his lifetime: This, however, was not done; and it was not printed until 1736, many years after Newton's death, when Colson translated it into English, and added to it a comment.

Cotes. Moivre. Taylor.

In enumerating the early improvers of the fluxional calculus, Cotes deserves particularly to be mentioned: He discovered a very elegant property of the circle, by which the fluents of a certain class of rational fractions were determined by means of the trigonometrical tables and logarithms. Unfortunately for science this excellent mathematician died early in life. Newton had formed great expectations from him. His theorem forms the basis of his posthumous work, *Harmonia Mensurarum*, published in 1722, by his friend Dr Smith. The inventions of Cotes were extended and completed by De Moivre, in his *Miscellanea Analytica*, published in 1730. Dr Brook Taylor also holds a distinguished place in the higher class of those who extended the calculus. His *Methodus Incrementorum*, printed in 1715, contains in the second part many applications of fluxions to physico-mathematical problems. His theorem for the developement of any function of a binomial, leads to many beautiful applications of fluxions; and one of the greatest mathematicians in modern times, the late Lagrange, has made it the foundation of his theory of the calculus.

Nicholas and Daniel Bernoulli.

The science received considerable improvement from the mathematicians in Germany, particularly in that branch which relates to the fluents of fluxions, containing several variable quantities. The two Nicolas Bernoullis, one a son of James and the other a son of John Bernoulli, and Daniel Bernoulli, another son of John, gave, in the Leipsic Acts, and in the Petersburg Memoirs, a multitude of profound disquisitions relating to the calculus; and to these may be added the labours of their countryman Herman.

The dispute between the schools of Newton and Leibnitz tended to the improvement of the calculus, by the problems which each party proposed as challenges to the other. Thus Leibnitz, in order to feel the pulse of the English, as he expressed it, a short time before his death, proposed the problem of orthogonal trajectories, that is, curves which cut in a given angle a series of curves of the same given kind. Newton resolved the problem on the day he received it; but John Bernoulli did not consider his solution as complete, because he had not integrated the fluxional equation, but taken for granted that the manner of doing it was known. On the other side, Keill challenged Bernoulli, by name, to find the path of a projectile, moving in a medium, in which the resistance was as the square of the velocity. Bernoulli quickly resolved the problem, not only in that particular case, but also when the resistance was as any power whatever of the velocity. He then required that Keill should produce his own solution; but Keill had not resolved his problem himself, and in fact found it too hard. He therefore maintained a profound silence, and Bernoulli obtained a complete triumph over the English philosopher.

Taylor also proposed, as a challenge, a fluxion of a particular form to be integrated; this was addressed to *all mathematicians not English*. As John Bernoulli was understood to be particularly aimed at, he offered to wager fifty guineas that he could resolve Taylor's problem, and fifty more that he would propose a problem which Taylor should not resolve, but which he could resolve himself. Taylor did not accept this challenge: Bernoulli gave a solution of Taylor's problem in the Leipsic Acts.

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The new calculi excited a controversy of a different kind, respecting the accuracy of their principles. These were attacked on the continent by Niewentiit, and Rolle; and defended by Leibnitz, Varignon, and Saurin. In England, Dr Berkeley, Bishop of Cloyne, called in question, not only the logical accuracy of the reasoning employed to establish the theory of fluxions, but also the faith of mathematicians in general, in regard to matters of religion. He began the controversy in his work entitled the *Minute Philosopher*. But the principal attack was made in 1734, in *The Analyst, or a discourse addressed to an Infidel Mathematician*, (understood to be Dr Halley,) *wherein it is examined whether the object, principles, and inferences of the modern analysis are more distinctly conceived than religious mysteries and points of faith*. One of the best answers to the Bishop came from the pen of Benjamin Robins, in *A discourse concerning the nature and certainty of Sir Isaac Newton's method of Fluxions, and of Prime and Ultimate Ratios*. Berkeley, however, had some reason for his objections. The very concise manner in which the great inventor had promulgated his discovery, might leave room for a dispute about the accuracy of the terms. Instead of defending these, it was better to adopt a mode of explanation more intelligible, and consonant to the common methods of mathematical reasoning. This was done by Maclaurin, in his *Treatise of Fluxions*, (1742.) He has there placed the principles of the method upon the firm basis of geometrical demonstration; but his demonstrations are tedious, so that we fear few have patience enough to study the subject, as delivered in the first part of his work. The second, in which the subject is considered in the usual manner, and algebraic characters are employed, is very valuable, and indeed the whole work abounds with original views of the theories connected with fluxions, and it proves the author to belong to the highest class of mathematicians.

Maclaurin.

Simpson.

Before the publication of Maclaurin's treatise, Mr Thomas Simpson had given the first edition of his *New Treatise of Fluxions*, (1737.) He new modelled the work, and published it again in 1750. This was a very valuable work at the time it appeared, and, as far as it goes, is at the present time one of the best introductions to the method of fluxions in the English language.

Emerson.

Emerson's *Doctrine of Fluxions* came out in 1743. This has also been always much esteemed in England. It contains a great number of applications; but as it places the subject less within the reach of a beginner, Simpson's book is, we believe, more popular.

Euler.

It is to the celebrated Euler that the calculus is indebted for its greatest improvements. Indeed these are far too numerous to find a place in the brief view which our limits allow us to give of the progress of the science; even the titles of his various memoirs would fill several of our pages: his more remarkable works will be given in the list of books relating to the subject in the conclusion. That branch of the calculus which treats of the higher class of problems, *De maximis et minimis*, such as the solid of least resistance, the curve of swiftest descent, &c. was first reduced by him to the form of a distinct theory, in his *Methodus inveniendi Lineas Curvas Maximi Minimive proprietate gaudentes, Sive solutio Problematis Isoperimetrici latissimo sensu accepti*, (1744.) This theory was improved and new modelled by Lagrange, and denominated the *Method of Variations*. It is a remarkable instance of Euler's candour, that he took up the subject a second time, and laying aside his own theory, treated it according to La Grange's views, employing also the same notation. Euler's writings on the analysis of infinites, and the differential and integral calculus, are a treasure of analytical knowledge, richer than was ever before produced by the labours of an individual.

Fagnano.

A discovery made by an Italian mathematician, the Marquis Fagnano, or Fagnani, has contributed considerably to the improvement of a branch of the fluxional calculus. He found that it is always possible to assign two arcs of an ellipse, reckoned from one extremity of each axis, such, that their difference may be expressed by algebraic quantities; and that any hyperbola has a similar property. This curious theorem, which has led to some remarkable transformations of fluxional formulæ, appears to have been but little known in Britain, as we do not recollect to have seen it in any of the mathematical works published in this country until it was also found by our ingenious countryman, Mr Landen, who added to it another remarkable discovery, namely, that any hyperbolic arc may always be rectified by means of two elliptic arcs. This theorem was of great importance, because it reduced to elliptic arcs all fluents that had before been expressed by hyperbolic arcs. Legendre followed in the tract of Landen's discovery, and shewed, in the Memoirs of the Academy of Sciences of Paris, for 1786, that the rectification of any ellipse may be reduced to that of two others, which have their eccentricities as small or as great as we please.

Agnesi.

It is a circumstance highly honourable to female genius, that we have to mention an excellent treatise on this difficult branch of mathematics from the pen of a lady; we allude to *Analytical Institutions* in four books, written originally in Italian, by Donna Maria Gaetana Agnesi, Professor of the Mathematics and Philosophy in the University of Bologna. This work was first published in 1748. A mathematician of great eminence, Mr Bossut, translated the second volume of it into French, and inserted it in his course of mathematics, as the best treatise he could furnish on the differential and integral calculus. And an English mathematician, Mr Colson, (who translated Newton's *Fluxions*), translated it also into English, having studied the Italian language at an advanced period of life, for the express purpose of making himself master of the work. The historian of the mathematics, Montucla, bestows great praise on this extraordinary woman; and her own countryman, Frisi, who has himself excelled so much both in pure and mixed mathematics, calls her work *Opus nitidissimum, ingeniossissimum, et certe maximum quod adhuc ex fœminæ alicujus calamo proderat.* For an account of this lady, see AGNESI.

The invention of the Arithmetic of Sines, which is due to Euler, has contributed greatly to the improvement of the calculus, and to its application to the physico-mathematical sciences. Indeed, to Euler we are more or less indebted for almost every improvement it has received. He first discovered the criterion by which it may be determined whether a fluxional equation admits of an exact integral or not; but it was also found, about the same time, by two French mathematicians, Fontaine and Clairaut: this was about the year 1739 or 1740.

D'Alembert.

The method of *Partial Differences*, one of the greatest improvements in the calculus, was the invention of D'Alembert, who found it when he was inquiring into the figure which a musical string assumes during its vibrations. The germ of the discovery may, however, be traced to a memoir of Euler's in the Petersburg Commentaries for the year 1734; and to him we are also indebted for the form of the theory and its notation.

Newton, in explaining the method of fluxions, considered all quantities as generated by motion, a line by the motion of a point, a surface by the motion of a line, a solid by the motion of a surface, &c. Leibnitz, on the other hand, employed the consideration of infinitely little increments, (*infiniment petits*). Against both these methods, objections have been urged. It has been said, that motion is an idea quite foreign to pure mathematics, and therefore it ought not to be employed in establishing its doctrines; and still stronger objections have been urged against the introduction of infinitely small quantities into mathematics. Our ingenious countryman, Mr Landen, proposed to lay aside the consideration of motion in explaining fluxions, and, instead of the Newtonian theory, he proposed to substitute another, which he called the *Residual Analysis*: this was about the year 1760. His method has not been followed, but his candour in getting the better of national prejudice in favour of Newton's method, has procured him the approbation of foreign mathematicians.

Lagrange.

Lagrange, in the Berlin Memoirs for 1772, proposed to shew, that the theory of the developement of functions into series, contained the true principles of the differential calculus, independently of the consideration of infinitely small quantities or limits; and he demonstrated by this theory the theorem of Taylor, which he regarded as the fundamental principle of the calculus, and which had only been demonstrated by the help of the calculus itself, or else by the consideration of infinitely little quantities. This is the view of the subject which he has given in his *Theorie des Fonctions Analytiques*, published in 1792, and, at a later period, in his *Leçons sur le calcul des Fonctions*. These works have been much and justly admired, on account of the luminous views they present of many important points in the calculus. In explaining his method, the author has employed a new mode of notation; but although some of the best foreign writers have adopted his principles, they have generally adhered to the old notation, considering it more expressive and commodious than that which was proposed.

Waring.

Among the British mathematicians of later times, who have cultivated this calculus, Dr Waring is conspicuous. His writings are the only mathematical works published in this country, until of late years, that have kept pace with the improvements made in this science on the continent. We fear they are less read than they deserve, perhaps in consequence of their peculiar style, and being composed in the Latin tongue.

In concluding this introduction, we mention, with regret, the fact, that there is not a book in the English language from which any thing like a tolerable knowledge of the fluxional or differential calculus, in its present improved state, can be obtained. Such as wish to study this science beyond its mere elements, must have recourse to the writings of Euler, or to the French Treatises. La Croix composed a work in three quarto volumes, in which he professed to have collected, into one point of view, all the improvements contained in Euler's writings and in academical memoirs. A second edition, in which the work is somewhat enlarged, is now printing, and two volumes have already come to this country. There are other smaller works of great merit also in the French tongue; these, as well as some English treatises, which our limits will not admit of our noticing more particularly, will be found in the following list of writers on this subject:

List of writers on fluxions.

Newton, *De Analysi per equationes numero terminorum infinitas*, published in the *Commercium Epistolicum* in 1712, but circulated among his friends in MS. as early as 1669.

Newton, *Tractatus de quadratura curvarum*, published along with his *Optics* in 1704; also together with the treatise *De Analysi*, &c. by Jones, 1711.

Newton, *Principia*, Lib. II. Sect. II. Lem. 2. 1687.

Newton, *The Method of Fluxions and Infinite Series*, 1736.

Leibnitz, *Nova methodus pro maximis et minimis itemque tangentibus*, Leipsic Acts, Oct. 1684.

The History of the Discovery of Fluxions is contained in the *Commercium Epistolicum de varia re Mathematica inter celeberrimos præsentis seculi Mathematicos*,

History.

&c. Jussu Societatis Regiæ in lucem editum, 1712, and the third volume of *Opera Leibnitii*, 1768, also a collection of pieces of M. Desmaiseaux, the works of Wallis, and Ralphson's *History of Fluxions*.

James Bernoulli, *Analysis magni Problematis Isoperimetrici*, 1701.

John Bernoulli, *Opera Omnia*, 1742.

Leibnitz and Bernoulli, *Commercium Phil. et Math.* two vols. 4to. 1745.

De L'Hopital, *Analyse des Infiniment petits*, 1696.

Carré, *Methode pour la Mesure des Surfaces*, &c. 1700.

Cheyne, *Fluxionum methodus inversa*, 1703.

Harris, *Algebra*, 1702; and *Lexicum Technicum*, 1704.

Hayes, *A Treatise on Fluxions*, 1704.

Ditton, *Institution of Fluxions*.

Manfredi, *De constructione equationum differentialium primi gradus*, 1704.

Jones, *Synopsis Palmariorum Matheseos*, 1706.

Craig, *Methodus Figurarum Curvilinearum quadraturas determinandi*, 1685.

Craig, *De Calculo Fluentium*, 1718.

Taylor, *Methodus Incrementorum* 1715.

Reyneau, *Analyse Demontré*.

Reyneau, *Science de Calcul*, 1714.

Cotes, *Harmonia Mensurarum*, 1722.

Cotes, *Æstimatio errorum in mixta mathesi*.

Clarke, *An Institution of Fluxions*, 1726.

De Moivre, *Miscellanea Analytica*, 1730.

Stone, *The Method of Fluxions*, 1730.

Hodgson, *The Doctrine of Fluxions*, 1736.

Deidier, *Le Calcul differentiel et le Calcul Integral, &c.* 1740.

Simpson, *A Treatise on Fluxions*, 1737; also 1750.

Maclaurin, *A Treatise of Fluxions*, 1742, 2 vols. 4to.

Emerson, *The Doctrine of Fluxions*, 1743.

Agnesi, *Istituzioni Analytiche, &c.* 1748, 2 vols. 4to. There is a French Translation by Cousin, 1775, also an English Translation by Colson.

Cramer, *Introduction a l'Analyse des lignes Courbes*, 1750.

Stirling, *Methodus Differentialis*, 1753.

Euler, *Methodus inveniendi lineas curvas maximi minimive proprietate gaudentes*, 1744.

Euler, *Introductio in Analysin Infinitorum*, 1748.

Euler, *Institutiones Calculi Differentialis*, 1755.

Euler, *Institutiones Calculi Integralis*, 3 tom. 1768—1770, also in 4 volumes, 1792, 1793, 1794. Euler's Academical Memoirs relating to the calculus, are too numerous to admit of being specified here. A list of his writings, published and unpublished, is given in the edition of the *Institutiones calculi Differentialis*, printed at Pavia 1787. It occupies 30 quarto pages. See EULER.

Mascheroni, *Annotationes ad calculum integralem Euleri*, 1790. *Pars altera*, 1792.

Walmesly, *Analyse des mesures des rapports et des angles*, 1750.

Bougainville, *Traite du Calcul Integral*, 1754.

Robin's *Mathematical Tracts*, 1761.

Landen, *The Residual Analysis*, 1764.

Landen, *Mathematical Lucubrations*, 1755.

Landen, *Mathematical Memoirs*, 1780.

History.

Saunderson, *The Method of Fluxions*, 1756.

Lyons' *Fluxions*, 1758.

D'Alembert, *Opuscules Mathematiques*, 1761.

Condorcet, *Du Calcul Integral*, 1765.

Le Seur et Jacquier, *Elemens du Calcul Integral*, 1768.

Fontaine, *Traite de Calcul Diff. et Integral*, 1770.

Waring, *Miscellanea Analytica*, 1762.

Waring, *Meditationes Analyticæ*, 1776.

Cousin, *Leçons de Calcul differentiel et de Calcul Integral*, 1777, 2 vols. 8vo. also since in two vols. 4to.

Kramp's *Analyse des Refractions Astronomiques*.

L'Huillier, *Exposition Elementaire des Principes des Calculs Superieurs*, 1786.

L'Huillier, *Principiorum Calculi differentialis et integralis Expositio elementaris*, 1795.

Tabiescen, *Principia atque Historia inventionis calculi Differentialis et Integralis nec non methodi Fluxionum*, 1793.

Lacroix, *Traité du Calcul Differentiel et du Calcul Integral*, 3 vols. 4to, 1797; also *Traité Elementaire de Calcul differentiel et de Calcul Integral*, 1 vol. 8vo. 1802.

Vince, *The Principles of Fluxions*, 1795.

Lagrange *Calcul des Variations*, in the *Miscell. Taurinensia*, tom. ii. et iv.

Lagrange, *Theorie des Fonctions Analytiques*, 1797.

Lagrange *Leçons sur le Calcul des Fonctions*.

Bossut, *Traité de Calcul Differentiel, et de Calcul Integral*, 1798.

Carnot, *Reflexions sur la Metaphysique du Calcul Infinitesimal*, 1797.

Woodhouse, *The Principles of Analytical Calculation*, 1803.

Woodhouse, *A Treatise on Isoperimetrical Problems, and the Calculus of Variations*, 1810.

Spence, *An Essay on the Theory of the various Orders of Logarithmic Transcendentals*, 1809.

Ampere, *Recherches sur quelques, Points de la Theorie des fonctions derivées. Journal de l'Ecole Polytechnique* 13. *Cahier*, 1806.

Dealtry, *A Treatise on Fluxions*, 1810.

Du Bourguet *Traité Elementaire de Calcul Differentiel*, &c. 1811.

Garnier, *Leçons de Calcul Differentiel*, &c. 1811.

Legendre, *Exercices de Calcul Integral*, 1811.

The memoirs relating to the calculus, which have been published in the transactions of learned societies, are too numerous to admit of a particular description here. For these, the *Bibliotheca Mathematica* of M. Murhardt may be consulted: Also, the 7th volume of *Repertorium Commentationum, a societatibus Litterariis editarum*, published by M. Reuss. This volume, which is sold separate, contains the titles of all the mathematical memoirs inserted in the academical collections, and classed according to the different subjects.

The most beautiful applications which have been made of the calculus are to be found in the *Principia* of Newton, the *Mechanica* of Euler, the *Mecanique Analytique* of La Grange, and the *Mecanique Céleste* of La Place.

SECTION I.

Fundamental Principles of the Theory of Fluxions.

Article 1. In the branch of mathematical analysis, which is strictly called *Algebra*, quantities are distinguished into *known* and *unknown*; but, in some other branches, and particularly in the theory of fluxions, they are distinguished into *constant* and *variable*.

A constant quantity, is that which has always the same value.

A variable quantity, is that which may increase or decrease, and while it changes from one state of magnitude to another, passes through all the intermediate states.

Thus, in trigonometry, the radius of a circle is a constant quantity, and an arc of a circle, also its sine, tangent, and secant are variable quantities. In conic sections, the axes of the curves, and their parameters, are constant, and the abscissæ and ordinates are variable.

2. It is usual to denote constant quantities by the first letters of the alphabet, a, b, c, &c. and variable quantities by the last letters, z, y, x, &c. so that, in the equation $y^2=ax+bx^2$; x and y are to be regarded as variable, and a and b as constant.

A quantity which depends, in any way, upon another, so as to vary, according as the quantity on which it depends varies, is called a *function* of that quantity. If $y=ax^2+bx+c$; or if $y=\surd(a^2+bx;)$ or if $y=a^x$, in each case, y is called a function of x; the quantities a, b, c, are not considered, because they are supposed to be constant, and x alone to vary.

A quantity which depends upon two or more variable quantities, is also called a function of these quantities: Thus, if $y=av^2+bx^2$, then y is called a function of v and x.

A quantity may be considered as a function of another, provided it depend on it, although it be not directly expressed by that quantity, and even although the manner of expressing it is not known: Thus, in the equation $x^3+y^3=axy$, y may be regarded as a function of x, and, on the other hand, x as a function of y; because the one may be expressed, in terms of the other, by the resolution of a cubic equation. Also, the roots of an equation, of the fifth degree, are to be regarded as functions of its coefficients, because they depend entirely on them, although the manner of expressing each root is not known.

3. Functions are distinguished into *explicit* and *implicit*. A quantity y is an explicit function of another quantity x, when its value is given directly by that of x, without the resolution of any equation. But it is an implicit function, when an equation must be resolved before its value can be found. Thus, if $y=ax+bx^2+c$, then y is an explicit function of x. But if y be so related to x, that $y^3+x^3=axy$, in this case y is an implicit function of x.

Functions are also divided into *algebraic* and *transcendental*. Algebraic functions are such as, when reduced to their proper form, consist of a finite number of terms, or admit of the relation of their indeterminate quantities being expressed by an algebraic equation. Transcendental functions, on the other hand, do not admit of the relation of the variable quantities being expressed by algebraic equations, composed of a finite number of terms; thus, if y be a logarithm, of which x is the number, that is, if $y=\log. x$; or if $y=a^x$; or if $y=\sin. x$, then, in each case, y is a transcendental function of x.

4. A clear notion of the nature of a function of a variable quantity x may be obtained by considering that quantity as the abscissa of a curve, and y the function, as the corresponding ordinate. Thus, if $y=\surd(2ax-x^2)$; let a circle be described with a radius equal to a, and at any point in the diameter, let a perpendicular be drawn to terminate in the circumference; then, the distance of the perpendicular from the extremity of the diameter, or the abscissa, being taken as the representative of x, the perpendicular or ordinate, will represent y, and the manner in which y varies will be understood by supposing the ordinate to move along the diameter, from one extremity to the other, thus giving all possible values to x. A function of two variable quantities may in like manner be represented geometrically by one of the three co-ordinates of any point in a curve surface; the variable quantities on which the function depends being represented by the other two.

5. The hypothesis that a quantity may change from one state of magnitude to another, so as to pass through all the intermediate degrees of magnitude, gives rise to a property which belongs to all functions whatever, and which is the foundation of the theory of fluxions. The existence of this property may be proved in a general way, without any reference to particular functions.[*] But as very general reasoning is not so convenient in establishing the principles of a science as an examination of particular cases, we prefer the latter method, at least in the outset of a branch of mathematics which is considered as somewhat difficult.

We begin, then, with the particular algebraic function $u=x^3$: Let us suppose that x changes to $x+h$, and that corresponding to this change in the value of x, the function u changes to u', then $u'=x^3+3x^2h+3xh^2+h^3$, therefore $u'-u=3x^2h+3xh^2+h^3$ and $\frac{u'-u}{h}=3x^2+3xh+h^2$, that is,

$$\frac{(x+h)^3-x^3}{h}=3x^2+(3x+h)h.$$

The first member of this equation is a function of two indeterminate quantities x and h, which we suppose to be entirely independent of each other. Its numerator and denominator have the property of decreasing continually as h decreases, so that each may be as small as we please. As these are the corresponding increments of x^3 and x, the second member is a general expression for the ratio of the increments.[†] It is made up of two parts, one of which, $3x^2$, is independant of h, and the other, $(3x+h)h$, has the property of decreasing as h decreases, and of vanishing altogether when $h=0$: from which it appears, that although

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[*] See a Memoir in the 13th *Cahier of Journal de L'Ecole Polytechnique*, entitled, *Recherches sur quelques points de la Theorie des Fonctions derivées, &c.* By M. Ampère.

[†] Consulting brevity, we shall in general express any ratio by a fraction of which the numerator is the antecedent and denominator the consequent; thus, the ratio of N to D will be expressed by the fraction $\frac{N}{D}$; and, consequently, the ratio of N to 1 will be expressed by N.

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the numerator and denominator of the function $\frac{(x+h)^3-x^3}{h}$, or, in other words, the terms of the ratio expressed by that function, be supposed to decrease, yet the function can never be $=0$, but will approach to $3x^2$; so that this quantity is a *limit* to the function, or ratio, that is, a quantity to which it may continually approach, so as to differ from it at last by less than any assignable quantity.

The property which we have found to belong to the particular case $\frac{(x+h)^3-x^3}{h}$, extends to the general function $\frac{(x+h)^n-x^n}{h}$, *n* being any constant quantity whatever. In proving this, some writers proceed by the method of induction, and by deducing one case from another. Others employ the binomial theorem, supposing that theorem to be proved by the common operations of algebra. As we propose to deduce the binomial theorem, and others of a similar nature, from the fluxional calculus itself, we shall avoid all reference to it in establishing the principles, and give what we conceive to be a new and more elegant demonstration of the truth of the property in question. We shall in the first place, however, resolve the following

FUNDAMENTAL PROBLEM.

6. Let *v* be any positive quantity whatever, and *p* and *q* any two whole numbers, of which *q* is positive, and *p* either positive or negative. It is proposed to find two boundaries, between which the function $\frac{v^p-1}{v^q-1}$, $\left(\text{or } \frac{1-v^p}{1-v^q}\right)$, is always contained; that is, two expressions, one of which is always greater, and the other always less than the function.

Investigation.—Let us first suppose *v* to be less than unity, and the number *p* to be positive. Then because by division,

$$\frac{1}{1-v}=1+v+v^2+v^3 \ldots +v^{p-1}+v^p$$

we have

$$\frac{1-v^p}{1-v}=1+v+v^2+v^3 \ldots +v^{p-1},$$

the number of terms in the second member of this equation being *p*. Now as the terms of the series go on continually decreasing from the first to the last, the first term multiplied by *p* will be greater than their sum, and the last term multiplied by *p* will be less. If the number of terms be considerable, the same thing will happen if we multiply the second term and the last but one by *p*, and again the third and last but two, and so on. However, as we proceed, the results will differ less and less from the sum; and as there must be some quantity, which is a mean among all the terms, or which, when multiplied by their number, will give exactly their sum, if we suppose the two adjoining terms, which are, the one greater and the other less than this mean, to be v^m and v^{m+1}, the sum of all the terms will be less than pv^m, and greater than pv^{m+1}; therefore, putting P for some quantity between *m* and $m+1$, the sum will be expressed exactly by pv^P,[*] and so we shall have

$$\frac{1-v^p}{1-v}=pv^P, \text{ and } 1-v^p=p(1-v)v^P. \quad (1.)$$

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In considering the nature of the quantity P, it appears to have these four properties:

1. Its value depends on the value of *p*, and also on that of *v*, so that it is a function of *p* and *v*, which we suppose to be independent of each other.

2. It is always greater than 0, and less than *p*.

3. If *p* be supposed to increase, then P also increases.

4. The quantity P increases slower than *p*, so that if *p* is increased by an unit, P will not be increased by so much as an unit.

The first two properties are sufficiently evident. To prove the third and fourth, let us suppose that when *p* increases to $p+1$, then P becomes P′, thus we have,

$$pv^P=1+v+v^2 \ldots +v^{p-1}, \text{ (to } p \text{ terms,)}$$
$$(p+1)v^{P'}=1+v+v^2 \ldots +v^{p-1}+v^p, \text{(to } (p+1) \text{ terms.)}$$

Let the first of these two series be denoted by N; then we have evidently

$$pv^P=\text{N},\ (p+1)v^{P'}=\text{N}+v^p=1+v\text{N};$$

and hence, dividing the corresponding members of these equations the one by the other, we get

$$(p+1)v^{P-P'} \begin{cases} =p+\frac{pv^p}{\text{N}} \\ =\frac{p}{\text{N}}+pv \end{cases} \quad (2.)$$

Now we have evidently

$$\frac{pv^p}{\text{N}}=\frac{v^p+v^p+v^p+\text{\&c. (to } p \text{ terms)}}{1+v+v^2 \ldots +v^{p-1}},$$

$$\frac{p}{\text{N}}=\frac{1+1+1+\text{\&c. (to } p \text{ terms)}}{1+v+v^2 \ldots +v^{p-1}};$$

Then, as *v* is less than unity, the numerator of the first of these two expressions is manifestly less than its denominator, and the numerator of the second is greater than its denominator; therefore, the first fraction is less than unity, and the second greater; so that

$$\frac{pv^p}{\text{N}} < 1, \text{ and, } \frac{p}{\text{N}} > 1;$$

and hence, from equation (2),

$$(p+1)v^{P'-P} < p+1, \text{ and } (p+1)v^{P'-P} > 1+pv;$$

but *v* being less than unity, $1+pv > v+pv$, that is, $1+pv > (1+p)v$; therefore, also

$$(p+1)v^{P'-P} > (1+p)v.$$

From these expressions it appears, that

$$v^{P'-P} < 1; \text{ and } v^{P'-P} > v;$$

and hence, by multiplying the quantities on each side of the sign of inequality by v^P, we have

$$v^{P'} < v^P; \text{ and } v^{P'} > v^{P+1}.$$

As *v* is by hypothesis less than unity, we may conclude from the first of these expressions, that P′ is greater than P; and from the second, that P′ is less than P+1. Thus it appears, that the new value of P, which corresponds to $p+1$, is greater than its former value, but that it does not exceed its former value by so much as

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[*] Here we take for granted the obvious principle, that if a variable quantity pass from one state of magnitude to another without becoming infinite, it must successively have all intermediate degrees of magnitude.

1, and these are the two properties of the quantity P, which we proposed to demonstrate.

Since it appears from Equation (1), that when p is any positive integer number, then

$$1-v^p = p\,(1-v)\,v^P,$$

So also q being any other integer number, there must be a corresponding quantity Q, such that

$$1-v^q = q\,(1-v)\,v^Q\;;$$

where Q must have the same properties relatively to q that P has relatively to p; therefore, by dividing the one of these expressions by the other, we get

$$\frac{1-v^p}{1-v^q} = \frac{p}{q}\,v^{P-Q} \qquad (3.)$$

Let us suppose, for an instant, that p and q are equal, then, P and Q will also be equal, and each will be less than p or q. Now, let p be supposed to increase, then P will also increase; but as it does not increase so fast as p, the excess of P above Q will not increase so fast as the excess of p above q, and so P—Q will always be less than $p-q$. In like manner, if p were supposed to decrease, in which case $p-q$ and P—Q would be both negative, it will appear that the negative quantity P—Q would not increase so fast as the negative quantity $p-q$, so that in every case P—Q will be between 0 and $p-q$.

Let z denote some positive quantity that is less than unity; then, as we may assume that $p-q : P-Q :: 1 : z$, we have $P-Q = z\,(p-q)$. As z depends on P and Q, and these again on p, q and v; it follows, that z is a function of p, q and v. It is $=0$ when $p=q$, but in every other case it is a positive quantity, less than unity. By substituting $z\,(p-q)$ for P—Q, we have now

$$\frac{1-v^p}{1-v^q} = \frac{p}{q}\,v^{z(p-q)}.$$

Let $v=\frac{1}{u}$, so that v being less than unity, u will be greater than unity. Instead of v, let $\frac{1}{u}$ be substituted in the formula just now found, and it becomes

$$\frac{u^p-1}{u^q-1} = \frac{p}{q}\,u^{(1-z)\,(p-q)}.$$

As z is some quantity between 0 and 1, so also $1-z$ will be between 0 and 1; therefore, our formula, which has been investigated upon the hypothesis that v is less than 1, is also true when v is greater than 1.

We have hitherto supposed p to be a positive quantity; but to include in the formula the case of p being a negative quantity, let both sides of the equation be multiplied by v^{-p}, and we have

$$\frac{1-v^{-p}}{1-v^q} = \frac{-p}{q}\,v^{z(p-q)-p}.$$

Assume now $z(p-q)-p = z'\,(-p-q)$, and then $z' = \frac{z\,(p-q)-p}{-(p+q)}$: hence, as all possible values of z are included between 0 and 1, so, all possible values of z' will be included between $\frac{0\times(p-q)-p}{-(p+q)}$ and $\frac{1\times(p-q)-p}{-(p+q)}$, that is between $\frac{p}{p+q}$ and $\frac{q}{p+q}$; but, by hypothesis, p and q are positive quantities; therefore these fractions are positive quantities less than unity, and consequently their values are between 0 and 1, and so we have

$$\frac{1-v^{-p}}{1-v^q} = \frac{-p}{q}\,v^{z'(-p-q)},$$

z' being a quantity between 0 and 1: and here it is manifest, that if p' be put instead of $-p$, the second member of the equation will have the same form as before.

Upon the whole, then, it appears, *that* v *being any positive quantity whatever, and* p *and* q *any two whole numbers, of which* q *is positive, and* p *either positive or negative, we have always*

$$\frac{1-\mathrm{v}^p}{1-\mathrm{v}^q} = \frac{p}{q}\;\mathrm{v}^{z\,(p-q)}, \qquad \text{(A.)}$$

and here z *is a certain quantity, which in every case is of an intermediate magnitude between* 0 *and* 1; *and in the case of* p *being a negative number, is contained between the narrower limits of* $\frac{-\mathrm{p}}{-\mathrm{p}+\mathrm{q}}$, *and* $\frac{\mathrm{q}}{-\mathrm{p}+\mathrm{q}}$. And thus we have a complete solution of our problem.

7. We now return to the function which expresses the ratio of the corresponding increments of x^n and x, n being any quantity whatever. Supposing x to change its value, and become $x+h$, then x^n becomes $(x+h)^n$, and so the expression for the ratio of the increments is $\frac{(x+h)^n-x^n}{h}$. Let $\frac{x+h}{x} = v^q$; then $h = x\,(v^q-1)$, and $(x+h)^n = x^n v^{nq}$, and

$$\frac{(x+h)^n-x^n}{h} = x^{n-1}\;\frac{v^{nq}-1}{v^q-1}.$$

As we are at liberty to suppose q any number we please, it may evidently be assumed such a positive integer that $n\,q$ shall be a positive or negative integer. Let $n\,q=p$, and then by formula (A), last article, we have

$$\frac{v^p-1}{v^q-1}\left(=\frac{p}{q}\,v^{z\,(p-q)}\right) = n\,\left(v^q\right)^{z\,(n-1)},$$

and consequently,

$$\frac{(x+h)^n-x^n}{h} = n x^{n-1}\;\left\{\frac{x+h}{x}\right\}^{z\,(n-1)}; \qquad \text{(B.)}$$

and as, in formula (A), z denotes some function of v, p, and q, the value of which is always greater than 0, and less than 1, so here z denotes some function composed of x, h, and n, which is always of an intermediate magnitude between 0 and 1.

This formula shews distinctly the important analytical fact, that the expression for the ratio of the increments of x^n and x has always a finite value, whatever be the magnitude of h, the increment of x. Moreover, it gives us immediately two boundaries to that value; for, as z cannot be so little as 0, nor so great as 1, it follows that $z\,(n-1)$ cannot be so little as 0, nor so great as $n-1$, therefore the value of the expression $\left\{\frac{x+h}{x}\right\}^{z\,(n-1)}$ must always be between 1 and $\left\{\frac{x+h}{x}\right\}^{n-1}$; and that of the general expression for the ratio, between $n\,x^{n-1}$, and $n\,x^{n-1}\left\{\frac{x+h}{x}\right\}^{n-1} = n\,(x+h)^{n-1}$.

The formula also shews, that there is a *limit* to which the expression for the ratio approaches as h decreases;

for then the fraction $\frac{x+h}{x}$ approaches continually to unity, and as the boundaries to the value of the exponent $z(n-1)$ remain unchanged, the function $\left\{\frac{x+h}{x}\right\}^{z(n-1)}$ will continually approach to unity, and the general expression for the ratio to nx^{n-1}, which is evidently a *limit* to its value, because the expression $\left\{\frac{x+h}{x}\right\}^{z(n-1)}$ may differ less from unity than by any assignable quantity.

We have seen that the expression for the ratio is always between nx^{n-1} and $n(x+h)^{n-1}$. These two expressions may be included in this one, $n(x+h')^{n-1}$. where h' is put for a certain quantity greater than 0, and less than h. We may therefore express the ratio otherwise, thus:

$$\frac{(x+h)^n-x^n}{h}=n(x+h')^{n-1} \qquad (B')$$

and in order to have the two boundaries to its value, we have only to give to h' its two bounding values, viz. 0 and h. This is another formula, which shews also, in a very distinct manner, the properties of the expression for the ratio.

From this last formula, we have

$$(x+h)^n=x^n+n(x+h')^{n-1}h;$$

and as, similarly,

$$(x+h')^{n-1}=x^{n-1}+(n-1)(x+h'')^{n-2}h',$$

where h'' denotes some quantity between 0 and h', and consequently between 0 and h; we have, by substituting for $(x+h')^{n-1}$ its value,

$$(x+h)^n=x^n+nx^{n-1}h+n(n-1)(x+h'')^{n-2}hh'$$

and therefore

$$\frac{(x+h)^n-x^n}{h}=nx^{n-1}+n(n-1)(x+h'')^{n-2}h'.$$

This expression for the ratio is composed of two parts, one of which, nx^{n-1}, is entirely independent of the increment h, and the other $n(n-1)(x+h'')^{n-2}h'$ is a function of x and h, which can evidently never be infinite while h has a finite value, but which vanishes when $h=0$, because of its factor h', which is then $=0$. We may denote this second part of the expression simply by H, and then the ratio may be otherwise expressed, thus,

$$\frac{(x+h)^n-x^n}{h}=nx^{n-1}+\mathrm{H}, \qquad (B'')$$

H being a function of x and h, which vanishes when $h=0$, and from this expression the properties of the ratio may likewise be deduced. Hence also

$$(x+h)^n=x^n+nx^{n-1}h+\mathrm{H}h.$$

8. The property which we have demonstrated to belong to the function x^n enables us to prove that every algebraic function whatever, of a variable quantity x, has a corresponding property. Let

$$u=\mathrm{A}x^m+\mathrm{B}x^{m'}+\mathrm{C}x^{m''}+\&c.$$

be any integral algebraic function of x, and let u' denote the new value of u when x becomes $x+h$, that is, let

$$u'=\mathrm{A}(x+h)^m+\mathrm{B}(x+h)^{m'}+\mathrm{C}(x+h)^{m''}+\&c.$$

Then because $(x+h)^m=x^m+mx^{m-1}h+\mathrm{H}'h$, (last article), and similarly,

$(x+h)^{m'}=x^{m'}+m'x^{m'-1}h+\mathrm{H}''h$, and so on, we have

$$\begin{aligned}u'=&\mathrm{A}x^m+\mathrm{B}x^{m'}+\mathrm{C}x^{m''}+\&c.\\&+\mathrm{A}mx^{m-1}h+\mathrm{B}m'x^{m'-1}h+\mathrm{C}m''x^{m''-1}h+\&c.\\&+\mathrm{AH}'h+\mathrm{BH}''h+\mathrm{CH}'''h+, \&c.\end{aligned}$$

Let the quantity $\mathrm{AH}'+\mathrm{BH}''+\mathrm{CH}'''+\&c.$ which vanishes when $h=0$, be denoted by the single letter H, then putting u for $\mathrm{A}x^m+\mathrm{B}x^{m'}+\&c.$ we have

$$u'=u+(\mathrm{A}mx^{m-1}+\mathrm{B}m'x^{m'-1}+\mathrm{C}m''x^{m''-1}+\&c.)h+\mathrm{H}h,$$

and hence

$$\frac{u'-u}{h}=\mathrm{A}mx^{m-1}+\mathrm{B}m'x^{m'-1}+\&c.+\mathrm{H}.$$

Here it appears that the expression for the ratio $\frac{u'-u}{h}$ has precisely the same property as has been found to belong to the ratio $\frac{(x+h)^n-x^n}{h}$; it is composed of two parts, one a function of x only, and the other a function of x and h, which vanishes when $h=0$.

The fractional function

$$u=\frac{\mathrm{A}x^m+\mathrm{B}x^{m'}+\&c.}{ax^n+bx^{n'}+\&c.}$$

has the same property; for by the substitution of $x+h$ instead of x, the numerator becomes

$$\mathrm{A}x^m+\mathrm{B}x^{m'}+\&c.+(m\mathrm{A}x^{m-1}+m'\mathrm{B}x^{m'-1}+\&c.)h+\mathrm{H}'h,$$

and the denominator becomes

$$ax^n+bx^{n'}+\&c.+(nax^{n-1}+n'bx^{n'-1}+\&c.)h+\mathrm{H}''h.$$

$$\begin{aligned}\text{Put }\mathrm{A}x^m+\mathrm{B}x^{m'}+\&c.&=\mathrm{N},\\m\mathrm{A}x^{m-1}+m'\mathrm{B}x^{m'-1}+\&c.&=\mathrm{N}'\\ax^n+bx^{n'}+\&c.&=\mathrm{D}\\nax^{n-1}+n'bx^{n'-1}+\&c.&=\mathrm{D}'\end{aligned}$$

and we have

$$u'=\frac{\mathrm{N}+\mathrm{N}'h+\mathrm{H}'h}{\mathrm{D}+\mathrm{D}'h+\mathrm{H}''h}.$$

This expression, by actual division, is easily transformed to

$$\frac{\mathrm{N}}{\mathrm{D}}+\frac{\mathrm{DN}'-\mathrm{ND}'}{\mathrm{D}^2}h+\mathrm{H}h,$$

in which, as in former cases, H is put to denote briefly that part of the quotient which is multiplied by one or other of the three quantities h, H′ and H″, and which, consequently, vanishes when $h=0$; therefore observing that $\frac{\mathrm{N}}{\mathrm{D}}=u$, we have

$$\frac{u'-u}{h}=\frac{\mathrm{DN}'-\mathrm{ND}'}{\mathrm{D}^2}+\mathrm{H}.$$

As the quantities D, N′, N and D′ are all independent of h, it is manifest that, in this case, the ratio has the same property which we have shewn to belong to it in the others.

9. The determination of the ratio of the increments of logarithmic and exponential quantities, according to the plan we have laid down, requires that we resolve this other

Problem.

Let b and x denote two positive quantities, neither of which is unity, and let b be constant, and x variable. Also let u be such a function of x, that $x=b^u$. It is proposed to find two boundaries to the values of u; that is, two expressions, one greater and the other less than u.

Investigation.—Let m and n denote any two given numbers. Then, whatever be the values of the quantities x and b, provided they are both greater than unity, it will always be possible to find two whole numbers p and q, and a positive quantity v, such that

$$v^p=x^{\frac{1}{n}},\ v^q=b^{\frac{1}{m}}.$$

For, in order to determine them, we have by the theory of logarithms,

$$p\log.v=\frac{1}{n}\log.x,\text{ and }q\log.v=\frac{1}{m}\log.b.$$

and therefore

$$\frac{p}{q}=\frac{m\log.x}{n\log.b}.$$

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Hence p and q may be any two whole numbers, as great as we please, that have to each other the ratio of m log. x to n log. b, which indeed is incommensurable, but may be expressed by numbers as near to perfect accuracy as we choose.

The remaining quantity v will be found from the equation,

$$\text{Log. } v=\frac{1}{np}\text{ log. } x\text{; or this, log. } v=\frac{1}{mq}\text{ log. } b.$$

Now as by hypothesis $x=b^u$, and by assumption $x=v^{pn}$, and $b^u=v^{uqm}$; therefore $v^{pn}=v^{uqm}$, and hence $pn=uqm$, and $\frac{p}{q}=\frac{mu}{n}$. Also, since $v^p=x^{\frac{1}{n}}$, and $v^q=b^{\frac{z}{m}}$, therefore $v^{p-q}=\frac{x^{\frac{1}{n}}}{b^{\frac{1}{m}}}$. Let these values of v^p, v^q, v^{p-q}, and $\frac{p}{q}$ be substituted in the formula

$$\frac{v^p-1}{v^q-1}=\frac{p}{q}v^{z(p-q)},$$

which was investigated in Art. 6. and it becomes

$$\frac{x^{\frac{1}{n}}-1}{b^{\frac{1}{m}}-1}=\frac{mu}{n}\cdot\frac{x^{\frac{z}{n}}}{b^{\frac{z}{m}}};$$

and hence,

$$u=\frac{b^{\frac{z}{m}}}{x^{\frac{z}{n}}}\cdot\frac{n(x^{\frac{1}{n}}-1)}{m(b^{\frac{1}{m}}-1)} \qquad \text{(C)}$$

Where m and n are, as we have already observed, quantities of any magnitude whatever; and z is some quantity, always of an intermediate magnitude between 0 and 1.

This formula exhibits elegantly the boundaries to the value of u; for as z can never be so small as 0, nor so great as 1, if we put $z=0$ and $z=1$, we shall obtain two expressions, one of which is greater, and the other less than u. These boundaries are

$$\frac{n(x^{\frac{1}{n}}-1)}{m(b^{\frac{1}{m}}-1)} \text{ and } \frac{b^{\frac{1}{m}}}{x^{\frac{1}{n}}}\cdot\frac{n(x^{\frac{1}{n}}-1)}{m(b^{\frac{1}{m}}-1)}.$$

They are remarkable on account of their involving two arbitrary quantities m and n, which have no apparent connection with the function they serve to express. It also appears, that the bounding values of the function are to one another as $b^{\frac{1}{m}}$ to $x^{\frac{1}{n}}$; now as we are at liberty to give as great values to m and n as we please, this ratio may have any degree of nearness to a ratio of equality: Hence it appears, that the quantity u is a *limit*, to which its two boundaries and the intermediate expression $\frac{b^{\frac{z}{m}}}{x^{\frac{z}{n}}}\cdot\frac{n(x^{\frac{1}{n}}-1)}{m(b^{\frac{1}{m}}-1)}$ continually approach, as m and n are supposed to increase, and to which they may come nearer than by any assignable difference, and thus we have a complete solution of our problem.

10. If we suppose b to be the *basis* or radical number of a system of logarithms; then, in the equation $x=b^u$, u is the logarithm of the number x. (ALGEBRA, art. 330.) We have, therefore, from formula (C) this remarkable expression for the logarithm of a number:

$$\text{log. } x=\frac{b^{\frac{z}{m}}}{x^{\frac{z}{n}}}\cdot\frac{n(x^{\frac{1}{n}}-1)}{m(b^{\frac{1}{m}}-1)}, \qquad \text{(D)}$$

z being some quantity contained between 0 and 1, and m and n any numbers whatever.

As we may suppose m and n to be as great as we please, we can make $\frac{z}{m}$ and $\frac{z}{n}$ each as nearly $=0$, and consequently, the factor $\frac{b^{\frac{z}{m}}}{x^{\frac{z}{n}}}$ as nearly $=1$ as we please.

In effect, therefore, we may consider, that

$$\text{log. } x=\frac{n(x^{\frac{1}{n}}-1)}{m(b^{\frac{1}{m}}-1)} \qquad \text{(E)}$$

provided we do not limit the magnitude of the m and n, but regard them as greater than any assignable numbers. Under either of these forms the expression for the logarithm of a number is valuable, because it identifies logarithmic and exponential expressions with common algebraic quantities.

11. Perhaps, it may be doubted whether such an expression as $n(x^{\frac{1}{n}}-1)$, or $m(b^{\frac{1}{m}}-1)$ admit of any definite value, on account of the indefinitude of the numbers m and n. To remove this difficulty, we shall resolve this third

PROBLEM.

Let v be any positive quantity, and n any very great number, or rather a number greater than any assignable number: it is proposed to transform the expression $n(v^{\frac{1}{n}}-1)$ into another that shall be free from the indefinite quantity n: and also to calculate the value of the expression, in some particular case; for example, when $v=10$.

Solution.—Let V and V′ be two functions of v, so related to each other, that $2V'^2=V+1$: Then $2(V'^2-1)=V-1$, and $\frac{V+1}{V-1}=\frac{V'^2}{V'^2-1}$; but

$$\frac{V'^2}{V'^2-1}=\tfrac{1}{4}\frac{V'+1}{V'-1}+\tfrac{1}{4}\frac{V'-1}{V'+1}+\tfrac{1}{2}$$

as will appear by bringing the terms in the second member of the equation into a single fraction. Hence we have this identical equation.*

$$\frac{V+1}{V-1}=\tfrac{1}{4}\frac{V'+1}{V'-1}+\tfrac{1}{4}\frac{V'-1}{V'+1}+\tfrac{1}{2}$$

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* An *identical equation* is so called, because it may be changed into another which shall express merely that a certain quantity is equal to itself. The equation $\frac{1}{v^2-1}=\frac{1}{2}\frac{1}{v-1}-\frac{1}{2}\frac{1}{v+1}$ is of this kind, as will appear by reducing the terms in its second member to a common denominator. An identical equation differs from a common algebraic equation, such as $v^2-3v+2=0$, in this respect, that the latter holds true only when v has certain particular values, which, in the present case, are $v=1$ and $v=2$; but the other holds true when v has any value whatever. Many geometrical theorems, when expressed by algebraic symbols, are identical equations. The fourth proposition of the second book of Euclid's *Elements* produces this, $(x+y)^2=x^2+2xy+y^2$; and the ninth and tenth produce this other, $x^2+y^2=\frac{(x+y)^2}{2}+\frac{(x-y)^2}{2}$. In these x and y may have any magnitude whatever.

With a view to abridge, put t for $\frac{V-1}{V+1}$, and similarly t' for $\frac{V'-1}{V'+1}$, and, consequently, $\frac{1}{t'}$ for $\frac{V'+1}{V'-1}$, then the formula may be expressed thus:

$$\frac{1}{t}=\frac{1}{4t'}+\frac{t'}{4}+\tfrac{1}{2}. \qquad (1.)$$

Let us now suppose that V', V'', V''', &c. to $V^{(m)}$ ((m) denoting the number of accents over the last term) are a series of quantities each formed from that before it, exactly as V' is from V, or so that

$$2\,V'^2=V+1,\ 2\,V''^2=V'+1,\ 2\,V'''^2=V''+1, \text{ \&c.}$$

and let the fractions $\frac{V''-1}{V''+1}$, $\frac{V'''-1}{V'''+1}$, &c. to $\frac{V^{(m)}-1}{V^{(m)}+1}$ be briefly denoted by t'', t''', &c. to $t^{(m)}$, then from formula (1) we derive the following series of equations:

$$\frac{1}{t}=\frac{1}{4t'}+\frac{t'}{4}+\frac{1}{2},$$

$$\frac{1}{4t'}=\frac{1}{4^2t''}+\frac{t''}{4^2}+\frac{1}{2.4},$$

$$\frac{1}{4^2t''}=\frac{1}{4^3t'''}+\frac{t'''}{4^3}+\frac{1}{2.4^2},$$

$$\cdot\quad\cdot\quad\cdot\quad\cdot$$

$$\frac{1}{4^{m-1}t^{(m-1)}}=\frac{1}{4^m t^{(m)}}+\frac{t^{(m)}}{4^m}+\frac{1}{2.4^{m-1}}.$$

By adding the corresponding members of these equations into two sums, and rejecting what is common to both, we find

$$\frac{1}{t}=\begin{cases}\frac{t'}{4}+\frac{t''}{4^2}+\frac{t'''}{4^3}\ \cdots\cdots+\frac{t^{(m)}}{4^m}\\ +\frac{1}{2}+\frac{1}{2.4}+\frac{1}{2.4^2}\ \cdots\cdots+\frac{1}{2.4^{m-1}}\\ +\frac{1}{4^m t^{(m)}}.\end{cases}$$

Now, the numeral series being a geometrical progression, of which the first term is $\frac{1}{2}$, and last $\frac{1}{2.4^{m-1}}$, and common ratio $\frac{1}{4}$, its sum will be $\frac{2}{3}-\frac{2}{3.4^m}$; therefore, after substitution and transposition, we find

$$(2.)$$

$$\frac{1}{4^m t^{(m)}}=\begin{cases}\frac{1}{t}-\frac{2}{3}+\frac{2}{3.4^m}\\ -\left(\frac{t'}{4}+\frac{t''}{4^2}+\frac{t'''}{4^3}\ \cdots\cdots+\frac{t^{(m)}}{4^m}\right)\end{cases}$$

Let us now assume that

$$2\,V=v+\frac{1}{v},$$

Then $2(V+1)=v+2+\frac{1}{v}=\left(v^{\frac{1}{2}}+\frac{1}{v^{\frac{1}{2}}}\right)^2$; but $2(V+1)=4V'^2$, therefore,

$$2\,V'=v^{\frac{1}{2}}+\frac{1}{v^{\frac{1}{2}}}.$$

In the very same manner, it may be proved, that $2\,V''=v^{\frac{1}{4}}+\frac{1}{v^{\frac{1}{4}}}$; and in general, putting $n=2^m$, that

$$2V^{(m)}=v^{\frac{1}{n}}+\frac{1}{v^{\frac{1}{n}}}:$$

and as $t^{(m)}=\frac{V^{(m)}-1}{V^{(m)}+1}$; therefore,

$$t^{(m)}=\frac{v^{\frac{2}{n}}-2v^{\frac{1}{n}}+1}{v^{\frac{2}{n}}+2v^{\frac{1}{n}}+1}=\frac{\left(v^{\frac{1}{n}}-1\right)^2}{\left(v^{\frac{1}{n}}+1\right)^2}.$$

By substituting this value of $t^{(m)}$ in the denominator of the first member of equation (2), and n^2 instead of its equivalent 4^m; and also putting for $\frac{1}{t}$ its value $\left(\frac{v+1}{v-1}\right)^2=\frac{(v-1)^2+4v}{(v-1)^2}=1+\frac{4v}{(v-1)^2}$, we have

$$(3.)$$

$$\frac{\left(v^{\frac{1}{n}}+1\right)^2}{\left\{n\left(v^{\frac{1}{n}}-1\right)\right\}^2}=\begin{cases}\frac{4v}{(v-1)^2}+\frac{1}{3}+\frac{2}{3n^2}\\ -\left(\frac{t'}{4}+\frac{t''}{4^2}+\frac{t'''}{4^3}\ \cdots\cdots+\frac{t^{(m)}}{n^2}.\right.\end{cases}$$

And this identical equation holds true, m being any whole number whatever.

Because $2\,V=v+\frac{1}{v}$, and $2V'=v^{\frac{1}{2}}+\frac{1}{v^{\frac{1}{2}}}$, and $2\,V''=v^{\frac{1}{4}}+\frac{1}{v^{\frac{1}{4}}}$, &c. v must always be a positive quantity; but it may be of any magnitude whatever: And as, whatever be the value of v, the terms of the series v, $v^{\frac{1}{2}}$, $v^{\frac{1}{4}}$, &c. approach continually to 1, and very fast, if v be a large number, or a small fraction; therefore, the terms of the series V, V', V'', V''', &c. continued indefinitely, approaches continually to 1, which is their *limit.*

To discover the ratio according to which the terms of the series t, t', t'', &c. decrease; let us take any two succeeding terms, $t'=\frac{V'-1}{V'+1}$ and $t''=\frac{V''-1}{V''+1}$; the latter divided by the former is

$$\frac{t''}{t'}=\frac{V''-1}{V''+1}\cdot\frac{V'+1}{V'-1}=\frac{V''^2-1}{(V''+1)^2}\cdot\frac{V'+1}{V'-1}.$$

But because $2\,V''^2=V'+1$, we have $V''^2-1=\frac{1}{2}(V'-1)$; therefore

$$\frac{t''}{t'}=\frac{(V'-1)(V'+1)}{2(V''+1)^2\,(V'-1)}=\frac{V'+1}{2(V''+1)^2}.$$

We have found that the quantities V', V'', &c. approach continually to 1; therefore the ratios $\frac{t'}{t''}$, $\frac{t''}{t'''}$ &c. approach continually to $\frac{1}{4}$: hence it follows, that when any term t'' is found to be nearly $\frac{1}{4}$ of the term immediately before it, the same will be more nearly true of each of the following terms.

From what has been shewn, it appears that the series of formula (3.), viz.

$$\frac{t'}{4}+\frac{t''}{4^2}+\frac{t'''}{4^3}\cdots+\frac{t^{(m)}}{4^m},$$

as it advances, approaches in its form to a geometrical progression, of which the common ratio of the adjoining terms is $\frac{1}{16}$. It will therefore converge very fast, so that however great the number of terms may be, a few terms at the beginning will be nearly equal to its sum.

Let us now suppose that in formula (3), n is a very great number, or even greater than any assignable number; then as upon this supposition, $\frac{1}{n}$ can only be expressed by 0, we have $v^{\frac{1}{n}}+1=v^{0}+1=1+1=2$, and so the expression $\frac{(v^{\frac{1}{n}}+1)^2}{\left\{n(v^{\frac{1}{n}}-1)\right\}^2}$ will be simply, $\frac{4}{\left\{n(v^{\frac{1}{n}}-1)\right\}^2}$. Also the fraction $\frac{2}{3n^2}$ will vanish, and the series $-(\frac{t}{4}+\frac{t''}{4^2}+\frac{t'''}{4^3}+\&c.)$ will go on *ad infinitum*, so that upon the whole we have this rule.

To compute the value of the expression $n(v^{\frac{1}{n}}-1)$, in which v is any positive quantity, and n a very great number, so as to admit of being reckoned greater than any assignable number.

1. Compute $V=\frac{1}{2}(v+\frac{1}{v})$.

2. Also compute as many terms as may be necessary of the series of quantities V′, V″, V‴, &c. from the formulæ.

$$V'=\sqrt{\frac{V+1}{2}},\ V''=\sqrt{\frac{V'+1}{2}},\ V'''=\sqrt{\frac{V''+1}{2}},\ \&c.$$

each being formed from that before it, exactly according to the same law.

3. Lastly, compute an equal number of terms of the series t', t'', t''', &c. from the formulæ,

$$t'=\frac{V'-1}{V'+1},\ t''=\frac{V''-1}{V''+1},\ t'''=\frac{V'''-1}{V'''+1},\ \&c.$$

Then shall

$$\frac{1}{\left\{n(v^{\frac{1}{n}}-1\right\}^2}=\begin{cases}\frac{v}{(v-1)^2}+\frac{1}{12}\\ -(\frac{t'}{4^2}+\frac{t''}{4^3}+\frac{t'''}{4^4}+\&c.)\end{cases}$$

The series being supposed to proceed indefinitely.

Note. When any term of the series is found to be nearly $\frac{1}{16}$ of the term before it, the remainder of the series may be reckoned a geometrical progression, of which the common ratio is $\frac{1}{16}$, and therefore its sum will be nearly $=\frac{1}{15}$ of that term.

The formula gives the value of the square of the reciprocal of the quantity to be found, but thence the quantity itself may be readily obtained.

Calculation of the formula $n(v^{\frac{1}{n}}-1)$, supposing that $v=10$.

In this case

$V = 5.05$
$V' = 1.7392527130927$
$V'' = 1.1703103676146$
$V''' = 1.041707820748.$
$V^{\text{iv}} = 1.01037315420..$
$V^{\text{v}} = 1.0025899346...$
$V^{\text{vi}} = 1.000647274....$
$V^{\text{vii}} = 1.000161805....$

$\frac{v}{(v-1)^2} = .1234567901235$
$\frac{1}{12} = .0833333333333$

P = Sum of positive terms, .2067901234568

$\frac{1}{4^2}t' = .0168671164758$
$\frac{1}{4^3}t'' = .0012261377606$
$\frac{1}{4^4}t''' = .0000797965180$
$\frac{1}{4^5}t^{\text{iv}} = .0000050388826$
$\frac{1}{4^6}t^{\text{v}} = .0000003157452$
$\frac{1}{4^7}t^{\text{vi}} = .0000000197469$
$\frac{1}{16}$ of $\frac{1}{4^7}t^{\text{vi}}$ nearly $=\frac{1}{4^8}t^{\text{vii}} = .0000000012344$
Rem. of ser. nearly $=\frac{1}{15}\cdot\frac{1}{4^8}t^{\text{vii}} = .0000000000823$

N = Sum of negative terms, .0181784264458

$$P-N=\frac{1}{n^2(10^{\frac{1}{n}}-1)^2}=.1886116970110$$

$$\frac{1}{n(10^{\frac{1}{n}}-1)}=.434294481903.$$

$$n(10^{\frac{1}{n}}-1)=2.302585092994.$$

12. We have seen (Art. 10.) that in every system of logarithms, of which the *basis* or radical number is b,

$$\log.\ x=\frac{b^{\frac{z}{m}}}{x^{\frac{z}{n}}}\ \frac{n(x^{\frac{1}{n}}-1)}{m(b^{\frac{1}{m}}-1)},$$

m and n being any quantities, and z a certain unknown quantity between 0 and 1. In Briggs' system, which is that commonly in use, $b=10$; and we have now found, that in this case,

$$\frac{m(b^{\frac{1}{m}}-1)}{b^{\frac{z}{m}}}=2.302585092994=B.$$

Therefore, the common logarithm of any number x, is $\frac{n(x^{\frac{1}{n}}-1)}{x^{\frac{z}{n}}B}$. If we suppose e to be such a number that $\frac{m(e^{\frac{1}{m}}-1)}{e^{\frac{z}{m}}}=1$, which is evidently possible, then in a system of logarithms, of which e is the basis, $\log.x=\frac{n(x^{\frac{1}{n}}-1)}{x^{\frac{z}{n}}}$. This is the system first invented by Napier, and now called by some the Napierean system. Since, therefore, $\frac{n(x^{\frac{1}{n}}-1)}{x^{\frac{z}{n}}}=$ Nap. log. x, similarly $\frac{n(b^{\frac{1}{n}}-1)}{b^{\frac{z}{n}}}=$ Nap. log. b. Hence it appears, that the number B is the Napierean logarithm of 10, so that $e^B=10$, and B × com. log. e = com. log. 10=1; and hence com. log. $e=\frac{1}{B}=.434294481903$. By inspecting a table of logarithms, it appears that $e=2.718282$ nearly; its more accurate value will appear hereafter to be $e=2.718281828459$. Let us now denote the Napierean logarithm of any number x by inclosing the symbol for the number in a parenthesis, and putting the letter l before it thus, l. (x). Then, from what has been shewn in this article, we may infer, that in any system of which the basis is b,

$$\text{log. } x=\frac{n\left(x^{\frac{1}{n}}-1\right)}{x^{\frac{z}{n}}\,\text{l.}\,(b)}; \qquad \text{(F)}$$

and it is to be observed, that in Napier's system l. (b) =1.

From this formula, and the series which we have found for its developement in the preceding article, we may find the logarithm of any number whatever. Another developement of the same quantity will be given as an exemplification of the application of the fluxional calculus, which, however, does not converge so fast as that here given. The series more commonly known for the logarithm of a number, will also be investigated in the sequel.

13. We are now prepared to investigate the general expression for the ratio of the increments of logarithmic and exponential functions, and begin with $u=\text{log.}\,x$. Let us suppose, that when x becomes $x+h$, then u becomes u', hence, putting B for l. (b), (that is, for the Napierean logarithm of the basis of the system), we have, by formula (F),

$$u=\frac{n\left(x^{\frac{1}{n}}-1\right)}{\text{B}\,x^{\frac{z}{n}}},\quad u'=\frac{n\left\{(x+h)^{\frac{1}{n}}-1\right\}}{\text{B}\,(x+h)^{\frac{z}{n}}};$$

and therefore,

$$\text{B}\,u\,x^{\frac{z}{n}}=n\left(x^{\frac{1}{n}}-1\right),$$

$$\text{B}\,u'\,(x+h)^{\frac{z}{n}}=n\left\{(x+h)^{\frac{1}{n}}-1\right\};$$

and taking the difference, and dividing by h,

$$\frac{\text{B}\left\{u'(x+h)^{\frac{z}{n}}-u\,x^{\frac{z}{n}}\right\}}{h}=\frac{n\left\{(x+h)^{\frac{1}{n}}-x^{\frac{1}{n}}\right\}}{h}.$$

But, by formula (B), (Art. 7.) the second member of this equation is equal to

$x^{\frac{1}{n}-1}\left\{\frac{x+h}{x}\right\}^{z'\left(\frac{1}{n}-1\right)}$ (z' being a quantity between 0 & 1). Therefore,

$$\frac{\text{B}\left\{u'(x+h)^{\frac{z}{n}}-u\,x^{\frac{z}{n}}\right\}}{h}=x^{\frac{1}{n}-1}\left\{\frac{x+h}{x}\right\}^{z'\left(\frac{1}{n}-1\right)}.$$

As we are at liberty to suppose n as great as we please, and as z and z' are always of an intermediate magnitude between 0 and 1; if we suppose n to be very great, $\frac{z}{n}$, $\frac{z'}{n}$, and $\frac{1}{n}$ may be each reckoned =0, and then $(x+h)^{\frac{z}{n}}$, $x^{\frac{z}{n}}$, $x^{\frac{1}{n}}$, and $\left\{\frac{x+h}{x}\right\}^{\frac{z'}{n}}$ are each to be accounted =1; our formula becomes now simply,

$$\frac{\text{B}\,(u'-u)}{h}=x^{-1}\left\{\frac{x+h}{x}\right\}^{-z'};$$

and hence, substituting for u' and u their values,

$$\frac{\text{log. }(x+h)-\text{log. }x}{h}=\frac{1}{\text{B}\,x^{1-z'}\,(x+h)^{z'}}. \qquad \text{(G)}$$

From this formula we see, that the function which expresses the ratio of the increments of log. x, and x, has the general properties which we have shewn in Art. 7. to belong to the function which expresses the ratio of the increments of x^n and x; but that the expression for its boundaries has a different form. If we make $z'=0$, we get $\frac{1}{\text{B}\,x}$ for one boundary; and if we make $z'=1$, we have $\frac{1}{\text{B}\,(x+h)}$ for the other boundary; and between these, the value of the function expressing the ratio is always contained. Or we may indicate both boundaries at once, by this expression $\frac{1}{\text{B}\,(x+h')}$, where h' is some quantity greater than 0, and less than h; and, again, as $\frac{1}{x+h'}=\frac{1}{x}-\frac{h'}{x\,(x+h')}=\frac{1}{x}+\text{H}$, where H is put for a quantity that has the property of vanishing when h' or $h=0$; we have also

$$\frac{\text{log. }(x+h)-\text{log. }x}{h}=\frac{1}{\text{B}(x+h')}=\frac{1}{\text{B}x}+\text{H} \qquad \text{(G')}$$

14. Next let the function be a^x, where a denotes a constant positive quantity, and x any variable quantity. When x changes to $x+h$, then a^x changes to $a^{x+h}=a^x\,a^h$; therefore $a^{x+h}-a^x=a^x\,(a^h-1)$.

We have found (art. 9, and art. 12.) that if $x=b^u$, then $u=\frac{n\left(x^{\frac{1}{n}}-1\right)}{\text{B}x^{\frac{z}{n}}}$, n being any number, and z a certain quantity between 0 and 1, and B=l(b). In this formula put b^u instead of its representative x, and it becomes $u=\frac{n\left(b^{\frac{u}{n}}-1\right)}{\text{B}b^{\frac{zu}{n}}}$. To adapt this expression to our present purpose, change u into h, also b into a, and B into A, (that is, l (b) into l (a)) and it becomes $h=\frac{n\left(a^{\frac{h}{n}}-1\right)}{\text{A}a^{\frac{zh}{n}}}$, or putting for the present $\text{A}'=\text{A}a^{\frac{zh}{n}}$, we have $h=\frac{n\left(a^{\frac{h}{n}}-1\right)}{\text{A}'}$; and hence, $a^h=\left(1+\frac{\text{A}'h}{n}\right)^n$; and $a^h-1=\left(1+\frac{\text{A}'h}{n}\right)^n-1$.

Now we have found (art. 7.) that

$$(x+h)^n-x^n=n\,x^{n-1}\left(\frac{x+h}{x}\right)^{z(n-1)}h;$$

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therefore, putting in this expression 1 instead of x, and $\frac{A'h}{n}$ instead of h and z' for a certain quantity between 0 and 1, we get

$$\left(1+\frac{A'h}{n}\right)^n-1=A'\left(1+\frac{A'h}{n}\right)^{z'(n-1)}h;$$

but since $\left(1+\frac{A'h}{n}\right)^n=a^h$, the second member of the above equation is also equal to $\frac{A'h\,a^{z'h}}{\left(1+\frac{A'h}{n}\right)^{z'}}$; therefore after putting for A′ the expression it denotes, we get

$$a^h-1=\frac{Aha^{\frac{zh}{n}}a^{z'h}}{\left(1+\frac{Aha^{\frac{zh}{n}}}{n}\right)^{z'}}.$$

Now, as we have it in our power to make n as great as we please, let us suppose it a very great number; then $\frac{zh}{n}$ may be reckoned $=0$, and $a^{\frac{zh}{n}}=1$, and $\frac{Aha^{\frac{zh}{n}}}{n}=0$, thus we have simply $a^h-1=Aha^{z'h}$. (I)
and as $a^{x+h}-a^x=a^x(a^h-1)$, it follows, that

$$\frac{a^{x+h}-a^x}{h}=Aa^xa^{z'h}. \qquad \text{(K)}$$

z' being, as already stated, a quantity between 0 and 1.

This expression for the ratio of the increments of a^x and x agrees in its general properties with that for the ratio of x^n and x, (art. 7.) Its boundaries found by making $z'=0$ and $z'=1$ are Aa^xa^0 and Aa^xa^h; therefore, if we put h' for some quantity between 0 and h, we shall have

$$\frac{a^{x+h}-a^x}{h}=Aa^xa^{h'}. \qquad \text{(K′)}$$

And as again, by equation (I) of this article, $a^{h'}=1+Ah'a^{zh'}$, if we put $H=Ah'a^{zh'}$, where H denotes a quantity that vanishes when h' or $h=0$, we shall also have this formula $\frac{a^{x+h}-a^x}{h}=Aa^x+H$. (K″)

15. We come now to the circular functions sin. x, and cos. x, that is, the sine and cosine of x, an arc of a circle, the radius of which we shall assume $=1$; and we are to investigate in each case an expression for the ratio of the increments of the function, and of the arc, which we consider as its variable basis.

Supposing x and a to be any arcs, from the fourth of formulæ (C) ARITHMETIC OF SINES, *Art.* 12. we derive the following series of equations,

$$\text{Sin. }(x+2a)-\text{sin. }x=2\text{ sin. }a\text{ cos. }(x+a),$$
$$\text{Sin. }(x+4a)-\text{sin. }(x+2a)=2\text{ sin. }a\text{ cos. }(x+3a),$$
$$\text{Sin. }(x+6a)-\text{sin. }(x+4a)=2\text{ sin. }a\text{ cos. }(x+5a),$$
$$\cdots\cdot$$
$$\text{Sin.}(x+2na)-\text{sin.}\left\{x+2(n-1)a\right\}=$$
2 sin. a cos. $\left\{x+(2n-1)a\right\}$; the number of equations being n.

By taking the sums of the corresponding members of these equations, and rejecting the quantities found with opposite signs, we find

$$\text{Sin. }(x+2na)-\text{sin. }x=$$
$$2\text{ sin. }a\left\{\text{cos. }(x+a)+\text{cos.}(x+3a)+\text{cos. }(x+5a)+\right.$$
$$\left.\cdots\cdots+\text{cos.}(x+[2n-1]a)\right\}.$$

Now, if the greatest term of this series of cosines be multiplied by the number of terms, the product will be a quantity evidently greater than their sum; and if the least term be multiplied by their number, the product will be a quantity less than their sum;* therefore, between the greatest and least, there must be some cosine of an intermediate magnitude, such, that if it be multiplied by the number of terms, the product will be exactly equal to their sum. This quantity will have the form cos. $(x+Na)$ where N is some positive quantity of an intermediate magnitude between the co-efficients of a in the greatest and least terms of the series; it must therefore be less than $2n$: We have now

$$\text{Cos. }(x+a)+\text{cos.}(x+3a)\ldots+\text{cos. }\left\{x+(2n-1)a\right\}$$
$$=n\text{ cos. }(x+Na);\text{ and hence}$$
$$\text{Sin. }(x+2na)-\text{Sin. }x=\text{cos. }(x+Na)\,2n\text{ sin. }a.$$

Let us now put $h=2na$; then $a=\frac{h}{2n}$, and $Na=\frac{N}{2n}h$; as N is always less than $2n$, $\frac{N}{2n}$ will be a positive fraction less than 1, let us denote it by z, and also let us put n' or rather n instead of $2n$, and upon the whole we shall have

$$\text{Sin. }(x+h)-\text{sin.}x=\text{cos. }(x+zh)\,n\text{ sin. }\frac{h}{n},$$

and in this formula n may be any positive number whatever.

16. By the second of formulæ (C) ARITHMETIC of SINES, art. 12. we have the following series of equations,

$$\text{Cos. }x-\text{cos. }(x+2a)=2\text{sin. }a\text{ sin.}(x+a),$$
$$\text{Cos. }(x+2a)-\text{cos. }(x+4a)=2\text{sin. }a\text{ sin.}(x+3a),$$
$$\text{Cos. }(x+4a)-\text{cos. }(x+6a)=2\text{sin. }a\text{ sin. }(x+5a),$$
$$\cdots\cdot$$
$$\text{Cos. }\left\{x+2(n-1)a\right\}-\text{cos.}(x+2na)=$$
$$2\text{sin. }a\text{ sin. }\left\{x+(2n-1)a\right\};$$

the number of equations being n. Hence, by adding as in last article, we get

$$\text{cos.}x-\text{cos. }(x+2na)=$$
$$2\text{ sin. }a\left\{\text{sin.}(x+a)+\text{sin.}(x+3a)+\text{sin.}(x+5a)+\right.$$
$$\left.\cdots\cdot+\text{sin.}(x+[2n-1]a)\right\}$$

As the sum of this series of sines will be less than the greatest term multiplied by the number of terms, and greater than the least term multiplied by the same number, it must be exactly equal to some quantity of an intermediate magnitude multiplied by that number. This quantity may evidently have the form sin. $(x+Na)$, where N denotes a positive quantity less than $2n$; we have therefore

$$\text{sin. }(x+a)+\text{sin.}(x+3a)+\cdots\cdot\cdot$$
$$+\text{sin. }\left\{x+(2n-1)a\right\}=n\text{ sin.}(x+Na);$$

---

[*] In the series of arcs $x+a$, $x+3a$, $x+5a$, &c. the cosines of those less than a quadrant will be positive quantities; and the cosines of those greater than a quadrant, but less than three quadrants, will be negative. Here we reckon that to be the greatest term which is nearest to $+1$; and that to be the least which is nearest to -1.

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and hence,

$$\text{Cos.}\,x-\cos.(x+2na)=\sin.(x+\text{N}a)2n\sin.a,$$

As in last article, put $h=2na$, then $a=\frac{h}{2n}$, and $\text{N}a=\frac{\text{N}}{2n}h$: Put z for $\frac{\text{N}}{2n}$, so that z will always be a positive quantity less than 1. Then making the proper substitutions, and also putting n instead of $2n$, we get from last equation;

$$\text{Cos.}(x+h)-\cos.x=-\sin.(x+zh)n\sin.\frac{h}{n};$$

and in this expression, n may be any positive number whatever.

17. It is an axiom in geometry, that any arc which does not exceed a quadrant is of an intermediate magnitude between its sine and tangent. Now, z being put for some fraction between 0 and 1, and v for an arc less than a quadrant, the expression $\frac{\sin.v}{\cos.(zv)}$ may denote any quantity between $\sin.v$ and $\tan.v$; because when $z=0$ it becomes $\frac{\sin.v}{1}$; and when $z=1$ it becomes $\frac{\sin.v}{\cos.v}=\tan.v$; therefore while z increases from 0 to 1, the expression will increase from $\sin.v$ to $\tan.v$, and will have successively every degree of intermediate magnitude. Hence we may assume that $v=\frac{\sin.v}{\cos.(zv)}$, z being a fraction between 0 and 1. Then $\sin.v=v\cos.(zv)$. Instead of v put $\frac{h}{n}$, and we have $\sin.\frac{h}{n}=\frac{h}{n}\cos.\left(\frac{z}{n}h\right)$ and $n\sin.\frac{h}{n}=h\cos.\left(\frac{z}{n}h\right)$. Now we are at liberty to suppose n as great as we please, therefore the fraction $\frac{z}{n}$ may be as small, and $\cos.\left(\frac{z}{n}h\right)$ may differ from unity by as little as we please, and so n being indefinite, in respect of magnitude, we may express $n\sin.\frac{h}{n}$ by the arc h. We then get from the two formulæ,

$$\text{Sin.}(x+h)-\sin.x=\cos.(x+zh)n\sin.\frac{h}{n}.$$

$$\text{Cos.}(x+h)-\cos.x=-\sin.(x+zh)n\sin.\frac{h}{n},$$

these others:

$$\left.\begin{aligned}\frac{\text{Sin.}(x+h)-\sin.x}{h}&=\cos.(x+zh).\\ \frac{\text{Cos.}(x+h)-\cos.x}{h}&=-\sin.(x+zh).\end{aligned}\right\}\quad(\text{L})$$

Observing always that z is a positive fraction less than unity. And these expressions are the boundaries to the ratio of the increments, which we proposed to investigate.

If we put $z=0$, we get $\cos.x$ and $-\sin.x$ for one boundary to the functions which express the ratios; these quantities are manifestly *limits* to which they approach when h is supposed to decrease indefinitely; and if we make $z=1$, we get $\cos.(x+h)$ and $-\sin.(x+h)$ for another boundary: so that the first of the two functions is always between $\cos.x$ and $\cos.(x+h)$; and may be expressed generally thus, $\cos.(x+h')$, h' being some arc between 0 and h; and the other is between $-\sin.x$, and $-\sin.(x+h)$, and may similarly be expressed by $-\sin.(x+h')$: And as, by the ARITHMETIC OF SINES, art. 12. formulæ (D).

$$\text{Cos.}(x+h')=\cos.x-2\sin.\left(x+\frac{h'}{2}\right)\sin.\frac{h'}{2}$$

$$\text{Sin.}(x+h')=\sin.x+2\cos.\left(x+\frac{h'}{2}\right)\sin.\frac{h'}{2}.$$

If we put H to denote briefly the expression $-2\sin.\left(x+\frac{h'}{2}\right)\sin.\frac{h'}{2}$, and H′ to denote $-2\cos.\left(x+\frac{h'}{2}\right)\sin.\frac{h'}{2}$, where it is manifest that H and H′ are quantities which vanish, when h, and consequently when $h'=0$, we have also

$$\left.\begin{aligned}\frac{\text{Sin.}(x+h)-\sin.x}{h}&=\cos.x+\text{H}\\ \frac{\text{Cos.}(x+h)-\cos.x}{h}&=-\sin.x+\text{H}'\end{aligned}\right\}\quad(\text{L}')$$

18. We shall now bring into one point of view the different expressions for the ratio of the corresponding increments of the five simple functions considered in this section.

$$\frac{(x+h)^n-x^n}{h}=n(x+h')^{n-1}=nx^{n-1}+\text{H};$$

$$\frac{\log.(x+h)-\log.x}{h}=\frac{1}{\text{B}(x+h')}=\frac{1}{\text{B}x}+\text{H};$$

$$\frac{a^{x+h}-a^x}{h}=\text{A}a^{x+h'}=\text{A}a^x+\text{H};$$

$$\frac{\sin.(x+h)-\sin.x}{h}=\cos.(x+h')=\cos.x+\text{H};$$

$$\frac{\cos.(x+h)-\cos.x}{h}=-\sin.(x+h')=-\sin.x+\text{H};$$

and in each of these expressions, h' is some quantity greater than 0 and less than h.

By comparing these formulæ, it appears that the five functions,

$$x^n,\ \log.x,\ a^x,\ \sin.x,\ \cos.x,$$

have the following common properties:—

1. The expression for the ratio of the increment of each function to the increment of the variable quantity x, which serves as its basis, is always a finite quantity contained between two determinate boundaries.

2. The expression for each ratio may be resolved into two parts, one of which is independent of the increment h, and the other is a function of x and h, of such a nature, that it is always finite while h is finite, and vanishes when $h=0$.

3. From this last property, the function which expresses each ratio has always a *limit* to which its value approaches, as h decreases, and to which it may come nearer than by any assignable quantity; and it appears that in the case of the function x^n, this limit is nx^{n-1}; in the function $\log.x$ the limit is $\frac{1}{\text{B}x}$, B being the Napierean logarithm of the base. In the function a^x the limit is $\text{A}a^x$, A being the Napierean logarithm of a; and, lastly, in the two functions $\sin.x$ and $\cos.x$, the limits are $\cos.x$ and $-\sin.x$ respectively; so that each limit is a new function of x, peculiar to the original function from which it is derived. We have seen, (art. 8.) that the property of the limiting ratio extends to the algebraic functions $\text{A}x^m+\text{B}x^{m'}+$, &c. and $\frac{\text{A}x^m+\text{B}x^{m'}+,\ \&c.}{ax^n+bx^{n'}+,\ \&c.}$, which are composed from the simple algebraic function x^n; and in the same manner it will appear that the property belongs to every expression, composed in any manner whatever, by the opera-

tions of addition, subtraction, multiplication, and division, from the five elementary functions we have been considering; so that we may regard it as belonging to all functions whatever of a variable quantity x.

To express the proposition analytically under this extended form, it will be convenient to adopt a suitable notation; therefore, like as we have denoted the sine of an arc by the symbol $\sin. x$, and the logarithm of x by $\log. x$, also by $1(x)$, so we may now denote any function whatever, of a variable quantity x, by the symbol $f(x)$, or $F(x)$: and here it must be observed, that the letter f or F is not to be considered as a co-efficient, but as a characteristic, indicating that the expression $f(x)$ is formed in a determinate manner from the variable quantity x, and constant quantities. And as, by substituting $x+h$, instead of x, in the expression $\log. x$ it becomes $\log. (x+h)$, so, when $x+h$ is substituted instead of x in the expression $f(x)$, it becomes then $f(x+h)$.

Employing this notation, we may consider the following general analytical fact as sufficiently established.

Let $f(x)$ denote any expression or function, formed from a variable quantity x, and constant quantities. Suppose x to be augmented by the increment h, so as to become $x+h$; by which the function will change its value, and become $f(x+h)$: Then, in every case,

$$\frac{f(x+h)-f(x)}{h}=p+\mathrm{H}; \qquad \text{(M)}$$

where p is a new function of x, which is independent of h; and H is a function of x and h, which has the property of vanishing when $h=0$: So that p is a *limit* to which the function which expresses the ratio continually approaches, as h decreases.

19. The proposition may be put under another form. For from the formulæ which express the ratio of the increments, we have also these,

$$(x+h)^n=x^n+nx^{n-1}h+\mathrm{H}h,$$
$$\mathrm{Log.}(x+h)=\log. x+\frac{h}{\mathrm{B}x}+\mathrm{H}h,$$
$$a^{x+h}=a^x+\mathrm{A}a^xh+\mathrm{H}h,$$
$$\mathrm{Sin.}\ (x+h)=\sin. x+h\cos. x+\mathrm{H}h,$$
$$\mathrm{Cos.}\ (x+h)=\cos. x-h\sin. x+\mathrm{H}h,$$

and, in general,

$$f(x+h)=f(x)+ph+\mathrm{H}h. \qquad \text{(N.)}$$

From these formulæ we learn, that, if in $f(x)$, any function of a variable quantity, we substitute $x+h$ instead of x, h being some quantity independent of x, then $f(x+h)$, the new value of the function, is equivalent to an expression, one term of which is $f(x)$, the original function; another, ph, is the product of the first power of h by p, some function of x which is quite independent of h, and derives its form from that of the original function, and is deducible from it: and the remainder of the expression, viz. $\mathrm{H}h$, is the product of h by H, a function of x and h, which is finite, while h has a finite value, but which vanishes when $h=0$.

In the expression

$$f(x+h)=f(x)+ph+\mathrm{H}h,$$

the function p may be made the object of analytical investigation; but as p is also the limit of the ratio

$$\frac{f(x+h)-f(x)}{h}=p+\mathrm{H};$$

to determine that limit, and to find the co-efficient of the simple power of h in the developement of $f(x+h)$, are the same analytical problem.

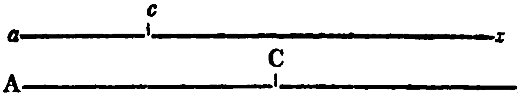
The property of a limit, which we have proved to belong to every variable function, affords a foundation for an analytic theory of great extent and importance. Its object is twofold:

1. To determine the limit to the ratio of the increments in any proposed function.

2. To determine, on the other hand, the function, having given the limit to the ratio of the increments.

This theory, considered under different points of view, is the *method of fluxions* of Newton, and the *differential calculus* of Leibnitz.

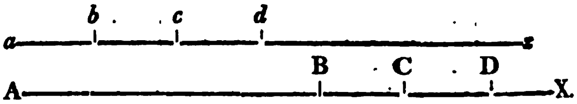
20. In explaining the method of fluxions, Newton, and almost all writers on the subject in this country, have employed considerations drawn from the theory of motion. According to their view of the subject, in order to represent a quantity $f(x)$ as a function of another variable quantity x, two points c and C are supposed to start at the same instant from the positions a, A, and to move along the lines $a\,x$, A X:



One of them, c, is supposed to move uniformly, and $a\,c$, the distance it has gone in any time, is taken as a geometrical expression for x: The motion of the other point, C, is supposed to be so regulated, that AC, the distance it has gone in the same time, may represent the function $f(x)$: If, for example, $f(x)=x^3$; then the number which expresses the line AC will always be the square of the number which expresses $a\,c$.

It is easy to see that there is no function whatever of a variable quantity which may not be conceived to be generated in this manner. And it also appears that while the point c that generates x moves uniformly, the point C that generates the function $f(x)$ will move faster or slower, according to the nature of the function, but never uniformly, except in the case when $f(x)$ has a constant ratio to x. In some cases it will continually increase, and in others it will decrease, or it may first increase, and then decrease, or *vice versa*, according to the particular nature of the function, which expresses the law of the motion.

21. Let us now enquire how these velocities, or the rates according to which the variable quantities increase and decrease, may be determined; and to fix our ideas, let us take the particular case of $f(x)=x^3$, so that the line AC is always the third power of the line ac.



Let us suppose that in two equal succeeding portions of time, the point that generates x, passes over the lines bc, cd, which will be equal, because the motion is uniform; also, that in the same equal intervals of time, the point which generates $f(x)$ passes over the corresponding lines BC, CD; these will be unequal, and the latter greater than the former; because when x has the successive values 1, 2, 3, 4, &c. which increase uniformly, the corresponding values of $f(x)$ are 1, 8, 27, 64, &c. which increase faster and faster. Let v and V denote the very velocities with which the generating points arrive at c and C, and s the space which would be described by the point C if it were to move with the velocity V, constant, during one of the equal intervals of time in which it actually describes the spaces BC, CD, with a variable velocity; then, because in the same time, the point c has described the equal spaces $b\,c$, $c\,d$ with the constant velocity v, we have, by the principles of motion, $\frac{\mathrm{V}}{v}=\frac{s}{b\,c}=\frac{s}{c\,d}$. Now, the

Fundamental Principles.

Fundamental Principles.

line BC being described with a variable velocity, that is always less than V, and CD with a variable velocity that is always greater than V; the line BC will be less than s, and the line CD greater than s, and consequently $\frac{BC}{bc}$, will be less than $\frac{s}{bc}$, and $\frac{CD}{cd}$ will be greater than $\frac{s}{od}$; therefore $\frac{V}{v} > \frac{BC}{bc}$; and $\frac{V}{v} < \frac{CD}{cd}$. This is evidently true, not only of $f(x)=x^3$, but of every function whatever generated with an increasing velocity. If, however, the velocity decrease, then, by a like mode of reasoning, it will be found that $\frac{V}{v} < \frac{BC}{bc}$, and $\frac{V}{v} > \frac{CD}{cd}$: So that, in every case the ratio of the velocities of the generating points at any contemporaneous position, is always between the ratio of any finite increments generated in an interval of time that ended when they arrived at that position, and the ratio of any finite increments generated in an interval of time that began when they left it; that is, the ratio of the velocities is greater than the one, but less than the other of these ratios; provided that while the increments are described, the velocities are always increasing, or always decreasing.

We have observed that the succeeding increments BC, CD generated in the same time must be unequal, because of the acceleration or retardation of the motion; the less, however, these increments are taken, the less will be the effect of the acceleration or retardation, and the more nearly will the ratio of the lines BC, CD approach to that of equality: Hence it follows, that, by continually diminishing the increments, the two ratios $\frac{BC}{bc}$ and $\frac{CD}{cd}$ may be as nearly equal as we please; and as the ratio $\frac{V}{v}$ is always between them, it must be a *limit* to both. Therefore, the ratio of the velocities of the generating points at any instant, is the limit of the ratio of the increments generated in any interval of time immediately preceding or succeeding that instant.

22. It appears, therefore, that the Newtonian mode of conceiving a variable quantity, and its function to change their value, gives rise to, and brings under contemplation, another class of quantities, namely, the velocities of the motions of the generating points; or the rates according to which the variable quantities increase or decrease. The variable quantities themselves have been called *Flowing Quantities*, also *Fluents*; and the velocities of the points which generate the variable quantities, have been called their *Fluxions*.

Although it must be allowed that a correct notion may be formed of the fluxion of a variable quantity from this definition, yet it has been rejected by all the foreign writers on the subject, and by some of the English: For it has been justly observed, that to introduce motion into a calculus which treats of algebraic quantities, is to bring in an idea quite foreign to the subject; and, moreover, according to this view of the matter, all quantities ought in strictness to be represented by lines; a mode of reasoning which, although accurate, is nevertheless inconvenient.

We have seen (Article 21.) that the determination of the velocities with which variable quantities are generated, leads us naturally to the limiting ratio of their corresponding increments, so that the fact, that every variable quantity has something related to it, which may be made the subject of mathematical investigation, namely, the velocity with which it increases, resolves itself ultimately into this other fact, that there is a certain determinable limit to the ratio of the corresponding increments of a function, and the variable quantity from which it is formed.

We have found that the existence of this ratio, and the manner of finding it, rests upon principles purely analytical. It seems, therefore, to have been entirely without necessity, that motion has ever been employed in explaining the theory of fluxions; and although we shall retain the terms *Fluxion* and *Fluent*, because no good purpose could be answered by exchanging them for others, we shall not hesitate to reject the cumbersome apparatus of reasoning, as well as the incommodious notation hitherto employed in this country, and adopt the more legitimate theory and convenient notation of the foreign writers.

Definitions and Notation.

23. Resuming the formula

$$\frac{f(x+h)-f(x)}{h}=p+\text{H},$$

in which fx denotes any function of a variable quantity x; h the increment of x; $f(x+h)$ the new value of the function when x changes to $x+h$; p that part of the general expression for the ratio which is independent of h, and which is always a new function of x, deducible from the original function $f(x)$; and H the other part of the expression which vanishes when $h=0$; and contemplating the analytical fact, that supposing h to decrease, the ratio $\frac{f(x+h)-fx}{h}$ approaches continually to the ratio of p to 1; we shall call this last the *Fluxional Ratio*. According to this definition, as in the function x^n, we have found that $\frac{(x+h)^n-x^n}{h}=n\,x^{n-1}+\text{H}$, (art. 7.), therefore

Fluxion of (x^n) : Fluxion of $x :: n\,x^{n-1} : 1$;

and in general

Fluxion of $f(x)$: Fluxion of $x :: p : 1$;

from which it follows that

Fluxion of $(x^n) = n\,x^{n-1} \times$ (Fluxion of x),

and in general, fluxion of $\left\{ f(x) \right\} = p \times$ fluxion of x.

By this definition, the quantity p enters always as a co-efficient into the expression for the fluxion of the function; we shall therefore call it the *Fluxional Coefficient*.

From this view of the subject, the fluxion of a function is not an absolute, but a relative quantity, which depends upon, and is co-existent with another quantity of the same kind, namely, the fluxion of the variable quantity x, from which the function is formed. We may therefore define the fluxions of a variable quantity, and any function of that quantity to be any indefinite quantities which have to each other the limiting ratio of their simultaneous increments.

The different views which Newton and Leibnitz took of this theory, and the claim of each to the invention, produced at first two distinct modes of notation, an inconvenience which the party spirit engendered by the dispute has rendered permanent. Newton at different times used different modes of notation; but that which he preferred, and which has been followed in general in Britain, was to denote the fluxion of a variable quantity by the letter which denotes the quantity, with the addition of a point over it; thus the fluxion of x is expressed by the character $\dot{x}$, that of u by $\dot{u}$, and so on.

Leibnitz and his adherents, on the other hand, having given the name *differential* to what Newton called a fluxion, they chose to denote it by prefixing the letter d (the first letter of the word) to the letter indicating the variable quantity: Thus what Newton expressed by $\dot{x}$ and $\dot{u}$, they expressed by dx and du.

In the first applications of this theory, it seems to have been a matter of indifference which of the two notations was employed. However, in the more extended applications of the science, the foreign notation appears to have been found the most convenient; for the best writers abroad, and particularly the celebrated Euler, who has improved this theory more than any other individual, have adopted it. The almost complete extinction of the dispute concerning the first invention of fluxions; the different views which have been taken of the subject; and more particularly the admirable discoveries of Euler, Lagrange, Legendre, La Place, and others, which have been consigned to posterity in the language of the foreign notation, and not yet expressed in that of Britain, have rendered the foreign notation quite familiar to mathematical readers in all countries; and in this country they seem to have produced a disposition in some to adopt it in preference to that hitherto employed. We are even disposed to think, that the incommodiousness of the British notation is the main reason, why so few improvements in this branch of mathematical science have been made in the country.

Viewing the matter thus, we do not scruple to adopt the foreign notation, as employed by the latest and best writers on this subject. We accordingly shall denote the fluxions of x and u by dx and du respectively; and it must be carefully observed, that the letter d prefixed to a quantity, does not mean a product of which d is a factor: the letter is prefixed to the quantity to indicate its fluxion, just as the letter r, which has since degenerated into the radical sign, was originally prefixed to a quantity to indicate its square root.

In expressing the powers of dx, the fluxion of a quantity x, we shall denote its second power by dx^2, its third by dx^3, and, in general, its nth power by dx^n.

By such an expression as $d(a+bx+cx^2)$, is meant the fluxion of the compound expression $a+bx+cx^2$.

The fluxion of the sine of an arc may be expressed thus, $d(\sin. x)$; and the same notation may be followed with respect to the curve, tangent, &c. Similarly the fluxion of $f(x)$, any function of a variable quantity x, may be indicated thus, $d\left\{f(x)\right\}$.

24. The theory of fluxions resolves itself into two principal enquiries.

First, Having given the relation of two variable quantities to find the relation of their fluxions. This branch has been called by the English writers, the *Direct Method of Fluxions*, and by foreigners *The Differential Calculus*.

Secondly, Having given the relation of the fluxions of two variable quantities, to determine thence the relation of the variable quantities themselves. This has been called in Britain the *Inverse Method*, and abroad the *Integral Calculus*. We proceed to treat of these in their order.

SECTION II.

Of the Direct Method of Fluxions.

25. In the direct method of fluxions, the first object of inquiry is, how to find the fluxion of any proposed function $f(x)$ relatively to the variable quantity x, which is regarded as its basis. The solution indicated by the definitions and notation is evidently this: *Find the fluxional coefficient; multiply it by the arbitrary symbol* d x, *which denotes the fluxion of the variable quantity* x; *and the product will be the fluxion sought.* Hence, the whole difficulty rests upon finding the fluxional coefficient.

We have investigated the fluxional coefficient in five different cases, which comprehend all the elementary functions of a general form, usually admitted into analysis. As we wish to investigate the binomial theorem and the series for logarithms, also the series for sines and cosines, by the theory of fluxions, we could not legitimately avail ourselves of their aid in establishing its principles, and therefore we have supplied the want of them by analytical artifices. In particular algebraic functions, however, the fluxional coefficient is easily found. Let us take, for example, the function x^3: By substituting $x+h$ for x, it becomes $x^3+3x^2h+3xh^2+h^3$. Therefore $\frac{(x+h)^3-x^3}{h}=3x^2+(3x+h)h$. By comparing this with the general formula $\frac{f(x+h)-fx}{h}=p+\mathrm{H}$, we find $\mathrm{H}=(3x+h)h$, and the fluxional coefficient $p=3x^2$. Hence, the fluxion of x^3 is $3x^2dx$. In the case of other integer powers of x, the fluxional coefficient and the fluxion are found with equal facility. Thus we have, in like manner,

$$\frac{(x+h)^4-x^4}{h}=4x^3+(6x^2+4xh+h^2)h;$$

and hence, in the case of the function x^4, we have $\mathrm{H}=(6x^2+4xh+h^2)h$, and the fluxional coefficient $p=4x^3$; and therefore $d(x^4)=4x^3dx$.

In these two examples, we have determined not only p, the fluxional coefficient, but also H, that part of the expression for the ratio which vanishes when $h=0$. Now this we do not want; all we have occasion for, is that part of the ratio which is independent of h.

Let the preceding equation be put under the form,

$$(x+h)^4=x^4+4x^3h+(6x^2+4xh+h^2)h^2,$$

and the general formula, $\frac{f(x+h)-fx}{h}=p+\mathrm{H}$, under the form

$$f(x+h)=f(x)+ph+\mathrm{H}h,$$

and it will appear that the rule for finding the fluxional coefficient may be expressed thus:

Substitute x + h *in the function instead of* x; *then find that term of its new value which is the product of the first power of* h *and* p, *a quantity quite independent of* h, *rejecting the terms which contain the higher powers of* h, *and in general every quantity which, although it be multiplied by* h, *yet vanishes when* h = 0; *and* p *shall be the fluxional coefficient: also the fluxion of the function will be immediately obtained by putting* d x *in that term instead of* h.

26. We shall now exemplify the general rule in finding the fluxions of the functions x^n, $\log. x$, a^x, $\sin. x$, and $\cos. x$.

I. Let $u=x^n$, n being any constant quantity. By

Direct Method.

substituting $x+h$ for x, the function becomes $(x+h)^n$. Now,

$$(x+h)^n=x^n+n\,x^{n-1}h+\text{H}\,h. \quad \text{(Art. 19.)}$$

Here, $n\,x^{n-1}h$ is the only part of this expression that consists of the first power of h multiplied by a coefficient which is independent of h; therefore, in this case, p, the fluxional coefficient, is $n\,x^{n-1}$; and changing h into $d\,x$, we have

$$d\,u=n\,x^{n-1}\,d\,x.$$

Hence this rule,

(A)

The fluxion of x^n, any constant power of a variable quantity, is the continual product of the exponent; a power of the same quantity, whose index is one less than the index of the power proposed; and the fluxion of the quantity.

II. Let $u=\log.x$. Then,

$$\log.(x+h)=\log.x+\frac{h}{x\,\text{l.}\,(b)}+\text{H}\,h; \quad \text{(Art. 19.)}$$

Here b denotes the basis of the system, and l. (b), the Napierean logarithm of b. Therefore, in this case, the fluxional co-efficient is $\frac{1}{x\,\text{l.}\,(b)}$, and

$$d\,u=\frac{d\,x}{x\,\text{l.}\,(b)}.$$

Hence this rule,

(B)

The fluxion of the logarithm of a variable number x is a fraction whose numerator is the fluxion of the number, and denominator is the product of the number by the Napierean logarithm of the basis of the system.

Note.—In the Napierean system, $\text{l.}\,(b)=1$. In the common system we have found, (Art. 12.),

$$\text{l.}\,(b)=2.302585092994=\text{B}.$$

$$\frac{1}{\text{l.}\,(b)}=0.434294481903=\frac{1}{\text{B}}.$$

III. Let the function be $u=a^x$, a being constant, and x variable. We have found that

$$a^{x+h}=a^x+a^x\text{l.}\,(a)h+\text{H}\,h, \quad \text{(art. 19.)}$$

Therefore, in this case, the fluxional co-efficient $p=a^x\,\text{l.}\,(a)$, and

$$d\,u=a^x\,d\,x\,\text{l.}\,(a).$$

This expression gives the following rule:

(C)

The fluxion of a variable power of a constant quantity is the continual product of that power; the Napierean logarithm of the constant quantity; and the fluxion of the variable exponent.

IV. Next, let $v=\sin.x$, $u=\cos.x$, then we have (art. 19.)

$$\text{Sin.}\,(x+h)=\sin.x+h\cos.x+\text{H}\,h;$$
$$\text{Cos.}\,(x+h)=\cos.x-h\sin.x+\text{H}\,h.$$

In the first of these expressions, the fluxional co-efficient is $\cos.x$, and in the second it is $-\sin.x$; therefore,

$$d\,v=d\,(\sin.x)=d\,x\cos.x;$$
$$d\,u=d\,(\cos.x)=-d\,x\sin.x.$$

In determining the limit of the ratio of the increments of the sine or cosine of an arc to that of the arc itself, (article 17.), we have considered the arc as the variable basis, and the sine and cosine as its function. But it is easy to see from the expression for the ratios, that the limit will be the very same, if on the contrary we consider the sine or the cosine as the variable basis, and the arc as the function. Since, then, upon the first hypothesis, we have the fluxional ratios $\frac{d\,(\sin.x)}{d\,x}=\cos.x$, and $\frac{d\,(\cos.x)}{d\,x}=-\sin.x$; we have, upon the other hypothesis, the fluxional ratios,

$$\frac{d\,x}{d(\sin.x)}=\frac{1}{\cos.x};\quad \frac{d\,x}{d\,(\cos.x)}=-\frac{1}{\sin.x}.$$

Or, putting u instead of x, reserving x to denote the variable basis of the function,

$$\frac{d\,u}{d\,(\sin.u)}=\frac{1}{\cos.u};\quad \frac{d\,u}{d\,(\cos.u)}=-\frac{1}{\sin.u}$$

Now put $\sin.u=x$, then $\cos.u=\sqrt{(1-x^2)}$, and from the first of these formulæ we have,

$$\frac{du}{dx}=\frac{1}{\sqrt{(1-x^2)}};\ \text{and}\ du=\frac{dx}{\sqrt{(1-x^2)}}.$$

Next, let $\cos.u=x'$, then $\sin.u=\sqrt{(1-x'^2)}$, and from the second formula we have.

$$\frac{du}{dx'}=\frac{-1}{\sqrt{(1-x'^2)}};\ \text{and}\ d\,u=-\frac{dx'}{\sqrt{(1-x'^2)}}.$$

Hence the following rule, which applies alike, whether the sine and cosine be considered as functions of the arc; or the arc be considered as a function of the sine or of the cosine.

(D)

The fluxion of the sine is equal to the fluxion of the arc multiplied by the cosine: and the fluxion of the arc is equal to the fluxion of the sine divided by the cosine.

The fluxion of the cosine is equal to the fluxion of the arc multiplied by the sine, and the negative sign prefixed to the result: and the fluxion of the arc is equal to the fluxion of the cosine (with the sign —) divided by the sine.

27. Let v and u be any functions of x, and let it be proposed to find the fluxion of $y=a+b\,v-c\,u$, where, a, b, c, denote constant quantities.

Let p and p' be the fluxional coefficients of v and u respectively. Then, (art. 19.) when x becomes $x+h$,

v becomes $v+ph+\text{H}h$,
and u becomes $u+p'h+\text{H}'h$.

Where H and H′ denote quantities composed of x and h, which have the property of vanishing when $h=0$: Let us suppose that when x becomes $x+h$, then y becomes y', then

$$\begin{aligned}y'&=a+b(v+ph+\text{H}h)-c(u+p'h+\text{H}'h)\\&=a+bv-cu+(bp-cp')h+(b\text{H}-c\text{H}')h;\end{aligned}$$

that is $y'=y+(bp-cp')h+\text{H}''h$,
where H″ is put for $b\text{H}-c\text{H}'$.

Hence it appears, that the fluxional co-efficient of y is $bp-cp'$, and therefore $dy=(bp-cp')dx=bpdx-cp'dx$: But p and p' being the fluxional co-efficients of v and u, $pdx=dv$, and $p'dx=du$; therefore

$$dy=adv-bdu.$$

Hence this rule,

(E)

The fluxion of a function which consists of several terms, is the sum of the fluxions of the terms, each retaining the sign and co-efficient of the term.

Note.—The fluxion of a constant term is to be reckoned $=0$.

28. It may perhaps appear almost self-evident, that if two functions of the same variable quantity be equal, their fluxions will also be equal. We shall, however, demonstrate this proposition, because of its great importance in the theory.

Let the two functions be $f(x)$ and $\text{F}(x)$, which we suppose are always equal, although they may be of a different form: For example, $f(x)$ may be $=\frac{2}{1-x^2}$, and $\text{F}\,(x)=\left\{\frac{1}{1-x}+\frac{1}{1+x}\right\}$, two expressions which form the members of the identical equation $\frac{2}{1-x^2}=\frac{1}{1-x}+\frac{1}{1+x}$.

Let p be the fluxional co-efficient of $f(x)$, and p' that of $\mathrm{F}(x)$; then when x becomes $x+h$, $f(x)$ becomes $f(x+h)=fx+ph+\mathrm{H}h$, and $\mathrm{F}(x)$ becomes $\mathrm{F}(x+h)=\mathrm{F}(x)+p'h+\mathrm{H}'h$ (art. 19.) and as the functions are supposed equal for all values of x, we must have

$$f(x)+ph+\mathrm{H}h=\mathrm{F}(x)+p'h+\mathrm{H}'h.$$

And since $f(x)=\mathrm{F}(x)$, therefore,

$$ph+\mathrm{H}h=p'h+\mathrm{H}'h;\ \text{and}\ p+\mathrm{H}=p'+\mathrm{H}'.$$

Now, p and p' are entirely independent of h, and H and H' vanish when $h=0$; therefore, in order that $p+\mathrm{H}$ and $p'+\mathrm{H}'$ may be universally equal, we must have $p=p'$, and $\mathrm{H}=\mathrm{H}'$: Hence $p\,dx=p'\,dx$, that is, $d\left\{f(x)\right\}=d\left\{\mathrm{F}(x)\right\}$.

The converse of this proposition does not hold true; for $2x\,dx$ may be the fluxion of x^2, or the fluxion of x^2+c, (c being any constant quantity). So that in general, from the equation $dv=du$, we may infer that $v=u+c$.

29. Let it be required to find the fluxion of the product of v and u two functions of x.

Let $y=vu$. Put p and p' for the fluxional co-efficients of v and u; then when x becomes $x+h$,

$$v \text{ becomes } v+ph+\mathrm{H}h,$$
$$u \text{ becomes } u+p'h+\mathrm{H}'h,$$
$$\text{and } y \text{ becomes } y';$$

therefore $y'=(v+ph+\mathrm{H}h)(u+p'h+\mathrm{H}'h)$, that is

$$y'=\left\{\begin{array}{l} vu+(vp'+up)h \\ +\left\{u\mathrm{H}+p'(p+\mathrm{H})h+(v+ph+\mathrm{H}h)\mathrm{H}'\right\}h; \end{array}\right.$$

and putting y for vu; and $\mathrm{H}''h$, generally, for the amount of the terms that contain one or other of the three quantities $\mathrm{H}h$, $\mathrm{H}'h$, h^2, we have

$$y'=y+(vp'+up)h+\mathrm{H}''h.$$

Hence it appears that the fluxional co-efficient of y is $vp'+up$; and therefore $dy=(vp'+up)\,dx=vp'\,dx+up\,dx$. But $p'\,dx=dv$, and $p\,dx=du$, (art. 25.) therefore,

$$dy=v\,du+u\,dv.$$

Hence this rule,

(F)

To find the fluxion of the product of two functions of the same variable quantity: Multiply each function by the fluxion of the other, and add together the products.

If we divide the two sides of the equation $d(uv)=v\,du+u\,dv$ by uv, we have $\frac{d(uv)}{uv}=\frac{du}{u}+\frac{dv}{v}$, an expression from which we may readily find the fluxion of the product of any number of factors whatever. For, let us suppose that $u=st$, then

$$\frac{du}{u}=\frac{d(st)}{st}=\frac{ds}{s}+\frac{dt}{t};$$

and therefore,

$$\frac{d(stv)}{stv}=\frac{ds}{s}+\frac{dt}{t}+\frac{dv}{v}.$$

In the same manner it may be shewn, that whatever be the number of factors, we have always

$$\frac{d(stuv\ldots\&c.)}{stuv\ldots\&c.}=\frac{ds}{s}+\frac{dt}{t}+\frac{du}{u}+\frac{dv}{v}+\&c.$$

and hence the fluxion of the product $stuv\ldots\ldots\&c.$ is

$$stuv\ldots\&c.\times\left\{\frac{ds}{s}+\frac{dt}{t}+\frac{du}{u}+\&c.\right\}.$$

If now each term be actually multiplied by the product $stuv\ldots\&c.$ the denominator will be taken away, and the result will give us this rule:

(G)

To find the fluxion of the product of any number of functions of a variable quantity x: Multiply the fluxion of each factor by the product of all the other factors, and the sum of all these results will be the fluxion required.

30. Next, let it be required to find the fluxion of the fraction $y=\frac{v}{u}$. Because $v=uy$, by rule (F), $dv=y\,du+u\,dy$; put $\frac{v}{u}$ instead of y in the second member, and we have $dv=\frac{v\,du}{u}+u\,dy$, and hence

$$dy=\frac{u\,dv-v\,du}{u^2}.$$

Hence the following rule,

(H)

To find the fluxion of a fraction, multiply the fluxion of the numerator by the denominator, and the fluxion of the denominator by the numerator; subtract the latter product from the former, and divide the remainder by the square of the denominator.

31. Let u be a function of a variable quantity x, and again let y be some function of u. It is required to investigate a general rule for finding the fluxion of y relatively to x.

Let p be the fluxional co-efficient of u relatively to x; then when x becomes $x+h$, u becomes $u+ph+\mathrm{H}h=u+k$, (putting k for $ph+\mathrm{H}h$). Again, let p' be the fluxional co-efficient of y relatively to u, then, when u becomes $u+k$; y considered as a function of u becomes $y+p'k+\mathrm{K}k$, (K being a quantity that vanishes when $k=0$); and, therefore, considered as a function of x, it becomes

$$y+p'(ph+\mathrm{H}h)+\mathrm{K}(ph+\mathrm{H}h)$$
$$=y+pp'h+(p'\mathrm{H}+p\mathrm{K}+\mathrm{K}\mathrm{H})h.$$

But as when $h=0$, then $k=0$; and consequently $\mathrm{K}=0$, we may put $\mathrm{H}''h$ for the last term of this expression, (H'' being a quantity which vanishes when $h=0$), and then it will appear that when x increases to $x+h$, y, considered as a function of x, increases to $y+p'p\,h+\mathrm{H}''h$. Therefore, (art. 25.), $p'p$ is the fluxional co-efficient of y relatively to x, and $dy=p'p\,dx$; but p being the fluxional co-efficient of u relatively to x, $p\,dx=du$; therefore, relatively to x, $dy=p'du$. Now this last expression is also the fluxion of y taken relatively to u, independently of x. Hence we have this rule

(I)

To find the fluxion of y a function of u, which is itself a function of a variable quantity x; find the fluxion of y considered as a function of u, without any regard to x: The result will have the form $p\,du$, next find the fluxion of u considered as a function of x, and substitute it in $p\,du$ and the result will be the fluxion of y relatively to x.

32. We shall now give some examples of the application of these rules.

EXAMPLE 1. Let $u=\sqrt{x}$, or, as it may be otherwise expressed, $u=x^{\frac{1}{2}}$. By rule (A), $du=\frac{1}{2}x^{\frac{1}{2}-1}dx=\frac{1}{2}x^{-\frac{1}{2}}dx$, or, $du=\frac{dx}{2\sqrt{x}}$.

Ex. 2. $u=\frac{1}{\sqrt{x^3}}$; that is, $u=x^{-\frac{3}{2}}$. In this case, by rule (A), $du = -\frac{3}{2}x^{-\frac{3}{2}-1}dx = -\frac{3}{2}x^{-\frac{5}{2}}dx = -\frac{3\,dx}{2\sqrt{x^5}}$.

Ex. 3. Let $u = a + b\sqrt{x} - \frac{c}{x}$. Rule (E) applies to this example; and as the term a is constant, we have $du = b\,d(x^{\frac{1}{2}}) - c\,d(x^{-1})$, now, by rule (A), $d(x^{\frac{1}{2}}) = \frac{dx}{2\sqrt{x}}$, and $d(x^{-1}) = -x^{-2}dx = -\frac{dx}{x^2}$; therefore, $du = \frac{b\,dx}{2\sqrt{x}} + \frac{c\,dx}{x^2}$.

Ex. 4. Let $u = \frac{x^2}{1-x}$. In this case, we apply rule (H), and as $d(x^2) = 2x\,dx$, and $d(1-x) = -dx$, we have $du = \frac{2(1-x)x\,dx + x^2\,dx}{(1-x)^2} = \frac{(2-x)x\,dx}{(1-x)^2}$.

Ex. 5. Let $y = (a + bx^m)^n$. Put $a + bx^m = u$, then $y = u^n$. This example belongs to rule (I), and proceeding as there directed, we have, by rule (A), $dy = nu^{n-1}du$, and from the equation $u = a + bx^m$, by rules (E) and (A), $du = mbx^{m-1}dx$. Therefore,

$$dy = mnb(a + bx^m)^{n-1}x^{m-1}dx.$$

Ex. 6. Let $y = x\sqrt{(a^2 + x^2)}$. Put $\sqrt{(a^2 + x^2)} = u$, and we have $y = xu$. Therefore, by rule (F), $dy = u\,dx + x\,du$. To find du or $d\left\{\sqrt{(a^2 + x^2)}\right\}$, we may assume $v = a^2 + x^2$, and then $u = \sqrt{v}$, therefore by rules (I), (E), and (A), $dv = 2x\,dx$, $du = \frac{dv}{2\sqrt{v}} = \frac{x\,dx}{u} = \frac{x\,dx}{\sqrt{(a^2 + x^2)}}$. Hence,

$$dy = dx\sqrt{(a^2 + x^2)} + \frac{x^2\,dx}{\sqrt{(a^2 + x^2)}} = \frac{(a^2 + 2x^2)dx}{\sqrt{(a^2 + x^2)}}.$$

Ex. 7. Let $y = x(a^2 + x^2)\sqrt{(a^2 - x^2)}$. Put $v = a^2 + x^2$, and $u = \sqrt{(a^2 - x^2)}$, and we have $y = xvu$; therefore, by rule (G), $dy = vu\,dx + xu\,dv + xv\,du$. Now $dv = 2x\,dx$, rules (A) and (E), and $du = \frac{-x\,dx}{\sqrt{(a^2 - x^2)}}$, rules (I) and (A), therefore, after substituting for v u, dv, du, their values, and reducing, we find

$$dy = \frac{(a^4 + a^2x^2 - 4x^4)dx}{\sqrt{(a^2 - x^2)}}.$$

We have substituted single letters for complex functions, with a view to refer each operation to a particular rule; but, in actual calculation, this will not always be necessary. Thus, in the 5th example, in which $y = (a + bx^m)^n$, by retaining the symbol $a + bx^m$, instead of substituting u for it, we have $dy = n(a + bx^m)^{n-1} \times d(a + bx^m)$, and as $d(a + bx^m) = b\,d(x^m) = mbx^{m-1}dx$, we have, as before, $dy = mnb(a + bx^m)^{n-1}x^{m-1}dx$.

Ex. 8. Let $y = (ax^3 + b)^2 + 2\sqrt{(a^2 - x^2)} \times (x - b)$.

In the first place,

$$d\left\{(ax^3 + b)^2\right\} = 2(ax^3 + b) \times d(ax^3 + b) = 6ax^2(ax^3 + b)dx.$$

Again, $d\left\{2\sqrt{(a^2 - x^2)} \times (x - b)\right\}$

$$2\sqrt{(a^2 - x^2)} \times d(x - b) + (x - b) \times d\left\{2\sqrt{(a^2 - x^2)}\right\}$$

But $d(x - b) = dx$, and $d\left\{2\sqrt{(a^2 - x^2)}\right\} = \frac{-2x\,dx}{\sqrt{(a^2 - x^2)}}$, therefore, upon the whole,

$$dy = 6ax^2(ax^3 + b)dx + \frac{(2a^2 - 4x^2 + 2bx)dx}{\sqrt{(a^2 - x^2)}}.$$

33. We shall next give examples of logarithmic functions, putting l. (z) for the Napierean log. of any function z.

Ex. 1. Let $u = \text{l.}\left(\frac{x}{\sqrt{(a^2 - x^2)}}\right)$. Put $\frac{x}{\sqrt{(a^2 - x^2)}} = z$, then by rule (B), $du = \frac{dz}{z}$: But by the rule for the fluction of a fraction,

$$dz = d\left(\frac{x}{\sqrt{(a^2 - x^2)}}\right) = \frac{a^2\,dx}{(a^2 - x^2)^{\frac{3}{2}}},$$

Therefore, $du = \frac{a^2\,dx}{x(a^2 - x^2)}$.

Ex. 2. Let $u = \text{l.}\left\{\frac{\sqrt{(1+x)} + \sqrt{(1-x)}}{\sqrt{(1+x)} - \sqrt{(1-x)}}\right\}$.

Put $y^2 = 1 + x$, $z^2 = 1 - x$;

Then $u = \text{l.}\left(\frac{y+z}{y-z}\right) = \text{l.}(y+z) - \text{l.}(y-z)$;

and $du = \frac{dy + dz}{y+z} - \frac{dy - dz}{y-z}$.

Now $2y\,dy = dx$, and $2z\,dz = -dx$.

Therefore $dy = \frac{dx}{2y}$, and $dz = \frac{-dx}{2z}$;

Hence we have

$$\frac{dy + dz}{y+z} = -\frac{y-z}{y+z}\cdot\frac{dx}{2yz} \text{ and } \frac{dy - dz}{y-z} = \frac{y+z}{y-z}\cdot\frac{dx}{2yz};$$

Therefore,

$$du = -\left\{\frac{y-z}{y+z} + \frac{y+z}{y-z}\right\}\frac{dx}{2yz} = -\frac{(y^2 + z^2)\,dx}{yz(y^2 - z^2)}$$

But $y^2 + z^2 = 2$, $y^2 - z^2 = 2x$, and $yz = \sqrt{(1 - x^2)}$:

Therefore, $du = \frac{-dx}{x\sqrt{(1 - x^2)}}$.

In the next two examples we shall merely give the results.

Ex. 3. $u = \text{l.}\left\{x + \sqrt{(1 + x^2)}\right\}$; $du = \frac{dx}{\sqrt{(1 + x^2)}}$.

Ex. 4. $u = \text{l.}\left\{\frac{\sqrt{(1 + x^2)} + x}{\sqrt{(1 + x^2)} - x}\right\}^{\frac{1}{2}}$; $du = \frac{dx}{\sqrt{(1 + x^2)}}$.

As an example of an exponential quantity, let $u = y^z$; supposing y and z to be any functions of a variable quantity x; then log. $u = z\,\text{l.}(y)$; Therefore, (Article 28.) $d\left\{\text{l.}(u)\right\} = d\left\{z\,\text{l.}(y)\right\}$; now $d\left\{\text{l.}(u)\right\} = \frac{du}{u}$ and $d\left\{z\,\text{l.}(y)\right\} = dz\,\text{l.}(y) + \frac{z\,dy}{y}$; by rules (B) and (F): Therefore, substituting y^z for u, we have

$$du = y^z\left\{dz\,\text{l.}(y) + \frac{z\,dy}{y}\right\}.$$

34. Examples in circular functions.

Ex. 1. Let $u = \text{tan.}\,x$. Because $\text{tan.}\,x = \frac{\text{sin.}\,x}{\text{cos.}\,x}$; therefore, $du = d\left(\frac{\text{sin.}\,x}{\text{cos.}\,x}\right) = \frac{\text{cos.}\,x\,d(\text{sin.}\,x) - \text{sin.}\,x\,d(\text{cos.}\,x)}{\text{cos.}^2\,x}$.

But $d(\text{sin.}\,x) = dx\,\text{cos.}\,x$, and $d(\text{cos.}\,x) = -dx\,\text{sin.}\,x$, rule (D): therefore $du = \frac{dx(\text{cos.}^2 x + \text{sin.}^2 x)}{\text{cos.}^2\,x} = \frac{dx}{\text{cos.}^2 x}$.

In the three following examples, we shall, for the sake of brevity, merely state the results.

Ex. 2. $u = \text{sec.}\,x$, $du = dx\,\text{tan.}\,x\,\text{sec.}\,x$.

Ex. 3. $u = \text{cot.}\,x$, $du = -\frac{dx}{\text{sin.}^2\,x}$.

Ex. 4. $u = \text{cosec.}\,x$, $du = -dx\,\text{cot.}\,x\,\text{cosec.}\,x$.

35. In the above examples, the tangent, secant, &c. are considered as functions of the arc: but we may reverse the hypothesis, and consider the arc as a function of the tangent, or secant, &c.

Ex. 1. Let it be required to find the fluxion of an arc

Direct Method.

considered as a function of its tangent. Put x for the tangent, and u for the arc. Then we may consider u as a function of sin u; and again sin. u and cos. u as functions of x. Now, by Rule (D), supposing u a function of sin u, we have

$$du = \frac{d\,(\sin.\,u)}{\cos.\,u} \qquad (1).$$

And since by the ARITHMETIC *of Sines*, $\sin.\,u = x\cos.\,u$, therefore considering sin. u as a function of x, we have, by rule (F)

$$d\,(\sin.\,u) = d\,x\cos.\,u - x\,d\,(\cos.\,u) \qquad (2).$$

But $\cos.^2 u + \sin.^2 u = 1$; therefore, by rule (A), $\cos.\,u\,d(\cos.\,u) + \sin.\,u\,d\,(\sin.\,u) = 0$, and $d(\cos.\,u) = -\frac{\sin.\,u}{\cos.\,u}\,d(\sin.\,u) = -\,x\,d\,(\sin.\,u)$; hence, from equation (2) we have,

$$d\,(\sin.\,u) = d\,x\cos.\,u - x^2\,d\,(\sin.\,u),$$

and $(1+x^2)\,d\,(\sin.\,u) = d\,x\cos.\,u.$ (3.)

From equations (1) and (3), we have, by rule (I)

$$d\,u = \frac{d\,x}{1+x^2},$$

And since $1 + x^2 = \sec.^2 u = \frac{1}{\cos.^2 u}$, we have also

$$d\,u = \cos.^2 u\,d\,x.$$

Ex. 2. If we suppose u to be such a function of x that $\sec.\,u = x$, then, $\cos.\,u = \frac{1}{x}$. Now regarding u as a function of cos. u, we have, by rule (D) $du = -\frac{d(\cos.\,u)}{\sin.\,u}$; and again considering cos. u as a function of x, we have $d\,(\cos.\,u) = d\left(\frac{1}{x}\right) = -\frac{dx}{x^2}$; therefore by rule (I)

$$d\,u = \frac{d\,x}{x^2\sin.\,u} = \frac{d\,x}{\sec.^2 u\sin.\,u} = \frac{\cos.\,u\,d\,x}{\sec.\,u\sin.\,u};$$

Hence putting tan. u for $\frac{\sin.\,u}{\cos.\,u}$, we have also

$$d\,u = \frac{d\,x}{\sec.\,u\tan.\,u} = \frac{d\,x}{x\sqrt{(x^2-1)}}.$$

Ex. 3. Let $\cot.\,u = x$; then $\tan.\,u = \frac{1}{x}$: Now we have found that $d\,u = d\,(\tan.\,u)\cos.^2 u$, (Example 1.); but $d\,(\tan.\,u) = -\frac{d\,x}{x^2}$; therefore, $d\,u = -\frac{d\,x\cos.^2 u}{x^2}$, or since $x = \frac{\cos.\,u}{\sin.\,u}$,

$$d\,u = -\,d\,x\sin.^2 u = -\frac{d\,x}{1+x^2}.$$

Ex. 4. If $\operatorname{cosec.} u = x$; then, from the formula, $d\,u = \frac{d(\sin.\,u)}{\cos.\,u}$, and $\sin.\,u = \frac{1}{x}$, we easily find

$$d\,u = -\frac{dx}{\cot.\,u\operatorname{cosec.} u} = -\frac{d\,x}{x\sqrt{(x^2-1)}}.$$

Some Applications of the Theory.

36. Before we proceed farther in the explication of the theory of fluxions, we shall give a few examples of its application to the investigation of analytical and trigonometrical formulæ; employing the principle demonstrated in Art. 28, namely, that *if two functions of a variable quantity be universally equal to one another, their fluxional coefficients will also be equal.*

Direct Method.

By algebraic division,

$$\frac{1}{1-x} = 1 + x + x^2 + x^3 \ldots + x^{n-1} + \frac{x^n}{1-x};$$

and therefore,

$$\frac{x\,(1-x^n)}{1-x} = x + x^2 + x^3 + x^4 \;\ldots\; + x^n. \qquad (a)$$

where n denotes the number of terms of the series. As the members of this equation are equal functions of the same variable quantity x, their fluxions must be equal. Now the fluxion of the first member is by rules (A) and (H)

$$\frac{(1-x)\left\{1-(n+1)\,x^n\right\}d\,x + x\,(1-x^n)\,d\,x}{(1-x)^2}$$

$$= \frac{\left\{1-(n+1)x^n + n\,x^{n+1}\right\}d\,x}{(1-x)^2}$$

And the fluxion of the second member is

$$d\,x + 2\,x\,d\,x + 3\,x^2\,d\,x \;\ldots\; + n\,x^{n-1}\,d\,x:$$

Hence, putting these expressions equal to one another; also, dividing both by $d\,x$, and multiplying by x, we get

$$\frac{x\left\{1-(n+1)\,x^n + nx^{n+1}\right\}}{(1-x)^2} = \qquad (b)$$

$$x + 2\,x^2 + 3\,x^3 + 4\,x^4 \;\ldots\; + n\,x^n.$$

This formula may be easily verified by multiplying the second member of the equation by the denominator of the first.

Let us now, in order to abridge, put

$$X' = \frac{1-(n+1)x^n + n\,x^{n+1}}{(1-x)^2};$$

Then, by formula (b),

$$X'x = x + 2\,x^2 + 3\,x^3 + 4\,x^4 \;\ldots\; + n\,x^n, \qquad (c)$$

then, taking the fluxion of each side as before, and denoting briefly $d\,(X'\,x)$ by $X''\,d\,x$, where X'' is a function of x, which may be found by rules (F), (H), and (I), we have

$$X''dx = d\,x + 2^2\,x\,d\,x + 3^2\,x^2\,d\,x \;\ldots\; + n^2\,x^{n-1}\,d\,x;$$

and hence, dividing by $d\,x$, and multiplying by x, we find

$$X''\,x = x + 2^2\,x^2 + 3^2\,x^3 + 4^2\,x^4 \;\ldots\; + n^2\,x^4.$$

From the process by which formulæ (b) and (c) have been deduced from formula (a), it appears that if we put $\frac{1-x^n}{1-x} = X$, and compute the series of functions X', X'', X''', &c. from the fluxional formulæ

$$\frac{d\,(x\,X)}{d\,x} = X',\; \frac{d\,(x\,X')}{d\,x} = X'',\; \frac{d\,(x\,X'')}{d\,x} = X''', \text{ \&c.}$$

then we shall have

$$X\,x = x + x^2 + x^3 + x^4 \;\ldots\; + x^n;$$
$$X'\,x = x + 2x^2 + 3x^3 + 4x^4 \;\ldots\; + n\,x^n;$$
$$X''x = x + 2^2\,x^2 + 3^2x^3 + 4^2\,x^4 \;\ldots\; + n^2x^n;$$
$$X'''x = x + 2^3\,x^2 + 3^3\,x^3 + 4^3x^4 \;\ldots\; + n^3\,x^n;$$

&c. &c.

where n may be any whole number whatever, and x any quantity greater or less than unity. In the particular case of $x=1$, the formulæ are not immediately applicable, because then the numerator and denominator of the expressions $X\,x$, $X'\,x$, &c. vanish at the same time. We shall shew, farther on, how quantities having this property are to be valued.

When x is a proper fraction, and n the number of terms infinite, the function X becomes simply $\frac{1}{1-x}$. In this case,

$$X'=\frac{1}{(1-x)^2};\ X''=\frac{1+x}{(1-x)^3};\ X'''=\frac{1+4x+x^2}{(1-x)^4},\ \&c.$$

Therefore,

$$\frac{x}{1-x}=x+x^2+x^3+x^4+\&c.$$

$$\frac{x}{(1-x)^2}=x+2x^2+3x^3+4x^4+\&c.$$

$$\frac{x(1+x)}{(1-x)^3}=x+2^2x^2+3^2x^3+4^2x^4+\&c.$$

$$\frac{x(1+4x+x^2)}{(1-x)^4}=x+2^3x^2+3^3x^3+4^3x^4+\&c.$$

&c. &c &c.

By the principle employed in this article, we may discover as many series, finite or infinite, as we please, that may be summed.

37. As an example of another mode of investigating series that may be summed, let us assume the series of identical equations.

$$1-x^2=(1+x)(1-x),$$
$$1-x^4=(1+x^2)(1-x^2),$$
$$1-x^8=(1+x^4)(1-x^4),$$
$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$
$$1-x^{2n}=(1+x^n)(1-x^n):$$

By taking the products of the two sides, and leaving out the factors common to both, we obtain

$$1-x^{2n}=(1-x)(1+x)(1+x^2)(1+x^4)\ \ldots\ \times(1+x^n).$$

Now it has been shewn, (Art. 29.) that supposing r, s, t, v, &c. to be any functions of x, if $y=rstv$, &c. then

$$\frac{dy}{y}=\frac{dr}{r}+\frac{ds}{s}+\frac{dt}{t}+\ \&c.$$

Therefore, assuming that

$y=1-x^{2n}$, $r=1-x$, $s=1+x$, $t=1+x^2$, $v=1+x^4$, &c. and taking the fluxions, we have

$$\frac{-2nx^{2n-1}dx}{1-x^{2n}}=\begin{cases}\dfrac{-dx}{1-x}+\dfrac{dx}{1+x}+\dfrac{2x\,dx}{1+x^2}+\dfrac{4x^3dx}{1+x^4}\\ \qquad\ldots+\dfrac{nx^{n-1}dx}{1+x^n};\end{cases}$$

and hence, by dividing all the terms by dx, and multiplying by x, and transposing the term $\frac{-x}{1-x}$, we find

$$\frac{x}{1-x}-\frac{2nx^{2n}}{1-x^{2n}}$$
$$=\frac{x}{1+x}+\frac{2x^2}{1+x^2}+\frac{4x^4}{1+x^4}\quad\ldots\quad+\frac{nx^n}{1+x^n}$$

This elegant analytical theorem holds true, independently of any particular value of x; and whatever be the number of the terms, observing that the exponents of the powers of x must be the terms of the geometrical series 1, 2, 4, 8, &c. the common ratio of which is 2.

38. Let us next assume this other series of identical equations.

$$x-1=(x^{\frac{1}{2}}-1)(x^{\frac{1}{2}}+1),$$
$$x^{\frac{1}{2}}-1=(x^{\frac{1}{4}}-1)(x^{\frac{1}{4}}+1),$$
$$x^{\frac{1}{4}}-1=(x^{\frac{1}{8}}-1)(x^{\frac{1}{8}}+1),$$
$$\cdot\quad\cdot\quad\cdot\quad\cdot\quad\cdot$$
$$x^{\frac{2}{n}}-1=(x^{\frac{1}{n}}-1)(x^{\frac{1}{n}}+1).$$

Hence, taking the products of the corresponding sides of the two series of equations, and rejecting the terms common to both, we find $x-1$ expressed by the product

$$(x^{\frac{1}{n}}-1)(x^{\frac{1}{2}}+1)(x^{\frac{1}{4}}+1)(x^{\frac{1}{8}}+1)\ldots\times(x^{\frac{1}{n}}+1).$$

Hence, proceeding as in last article, dividing the fluxion of each factor by the factor itself, and leaving out dx, which is common to all the terms, we find $\frac{1}{x-1}=$

$$\frac{x^{\frac{1}{n}-1}}{n(x^{\frac{1}{n}}-1)}+\frac{1}{2}\,\frac{x^{\frac{1}{2}-1}}{x^{\frac{1}{2}}+1}+\frac{1}{4}\,\frac{x^{\frac{1}{4}-1}}{x^{\frac{1}{4}}+1}$$
$$+\frac{1}{8}\,\frac{x^{\frac{1}{8}-1}}{x^{\frac{1}{8}}+1}\ \cdot\ \cdot\ \cdot+\frac{1}{n}\,\frac{x^{\frac{1}{n}-1}}{x^{\frac{1}{n}}+1};$$

and by transposing and multiplying all the terms by x, we find

$$\frac{x^{\frac{1}{n}}}{n(x^{\frac{1}{n}}-1)}=\frac{x}{x-1}$$
$$-\left(\frac{1}{2}\,\frac{x^{\frac{1}{2}}}{x^{\frac{1}{2}}+1}+\frac{1}{4}\,\frac{x^{\frac{1}{4}}}{x^{\frac{1}{4}}+1}\ \cdot\ \cdot\ \cdot+\frac{1}{n}\,\frac{x^{\frac{1}{n}}}{x^{\frac{1}{n}}+1}\right).$$

This equation holds true, whatever be the number of terms: but let us now suppose their number infinite; then the numerator of the expression $\frac{x^{\frac{1}{n}}}{n(x^{\frac{1}{n}}-1)}$ becomes $=1$, and the denominator is the Napierean log. of x, (Art. 12.) Hence we have

$$\frac{1}{\mathrm{l.}(x)}=\frac{x}{x-1}$$
$$-\left(\frac{1}{2}\,\frac{x^{\frac{1}{2}}}{x^{\frac{1}{2}}+1}+\frac{1}{4}\,\frac{x^{\frac{1}{4}}}{x^{\frac{1}{4}}+1}+\frac{1}{8}\,\frac{x^{\frac{1}{8}}}{x^{\frac{1}{8}}+1}+\ \&c.\right)$$

We may give this expression another form, by writing $\frac{1}{y}$ instead of x, and afterwards changing y into x, and observing that $\log.\left(\frac{1}{x}\right)=-\log.(x)$; we then have

$$\frac{1}{\mathrm{l.}(x)}=\frac{1}{x-1}$$
$$+\left(\frac{1}{2}\,\frac{1}{x^{\frac{1}{2}}+1}+\frac{1}{4}\,\frac{1}{x^{\frac{1}{4}}+1}+\frac{1}{8}\,\frac{1}{x^{\frac{1}{8}}+1}+\&c.\right)$$

By adding the corresponding sides of these two formulæ, we get this third formula,

$$\frac{1}{\mathrm{l.}(x)}=\frac{1}{2}\,\frac{x+1}{x-1}$$
$$-\left(\frac{1}{4}\,\frac{x^{\frac{1}{2}}-1}{x^{\frac{1}{2}}+1}+\frac{1}{8}\,\frac{x^{\frac{1}{4}}-1}{x^{\frac{1}{4}}+1}+\frac{1}{16}\,\frac{x^{\frac{1}{8}}-1}{x^{\frac{1}{8}}+1}+\&c.\right)$$

which is better adapted to calculation than either of the others, because it converges faster; but it does not converge so fast as that which we have in Art. 11.

By taking the fluxions of both sides of this equation, we may find the expression for the reciprocal of the square of l.(x), which has been investigated by a different method in Art. 11; and repeating the process, we may obtain expressions for the reciprocal of its third and higher powers.

39. By the ARITHMETIC *of Sines*, formulæ (G),

$$\text{Sin. }x=\text{sin. }\tfrac{1}{2}x\times2\text{ cos. }\tfrac{1}{2}x,\ \text{and sin. }\tfrac{1}{2}x=$$
$$\text{sin. }\tfrac{1}{4}x\times2\text{ cos. }\tfrac{1}{4}x.$$

Therefore,

$$\sin. x = 2^2 \sin. \tfrac{1}{4} x \cos. \tfrac{1}{2} x \cos. \tfrac{1}{4} x;$$

Again, because $\sin. \frac{1}{4} x = \sin. \frac{1}{8} x \times 2 \cos. \frac{1}{8} x$; therefore

$$\sin. x = 2^3 \sin. \tfrac{1}{8} x \cos. \tfrac{1}{2} x \cos. \tfrac{1}{4} x \cos. \tfrac{1}{8} x.$$

And, in general, putting m for the number of cosines, and $n = 2^m$,

$$\sin. x = n \sin. \tfrac{1}{n} x \cos. \tfrac{1}{2} x \cos. \tfrac{1}{4} x \ldots \times \cos. \tfrac{1}{n} x.$$

Hence, proceeding as in Art 37. we have

$$\frac{d. \sin. x}{\sin. x} = \frac{n\, d. \sin. \frac{1}{n} x}{n \sin. \frac{1}{n} x} + \frac{d. \cos. \frac{1}{2} x}{\cos. \frac{1}{2} x} \cdots + \frac{d. \cos. \frac{1}{n} x}{\cos. \frac{1}{n} x}.$$

By actually taking the fluxions of the numerators, and rejecting the common factor dx, we have

$$\frac{\cos. x}{\sin. x} = \frac{\cos. \frac{1}{n} x}{n \sin. \frac{1}{n} x} - \frac{\sin. \frac{1}{2} x}{2 \cos. \frac{1}{2} x} - \frac{\sin. \frac{1}{4} x}{4 \cos. \frac{1}{4} x} \cdots - \frac{\sin. \frac{1}{n} x}{n \cos. \frac{1}{n} x};$$

and hence, transposing and putting $\tan. x$ for $\frac{\sin. x}{\cos. x}$, &c.

$$\frac{1}{n \tan. \frac{1}{n} x} = \begin{cases} \dfrac{1}{\tan. x} + \frac{1}{2} \tan. \frac{1}{2} x + \frac{1}{4} \tan. \frac{1}{4} x \\ + \frac{1}{8} \tan. \frac{1}{8} x \ldots\ldots + \frac{1}{n} \tan. \frac{1}{n} x \end{cases}$$

This formula is true, whatever be the number of terms in the series. Let us now suppose the arc x indefinitely small, and n indefinitely great; in that case, $n \tan. \frac{1}{n} x = \text{arc } x$; hence, supposing the series to go on *ad infinitum*, we have

$$\frac{1}{x} = \frac{1}{\tan. x} + \tfrac{1}{2} \tan. \tfrac{1}{2} x + \tfrac{1}{4} \tan. \tfrac{1}{4} x + \tfrac{1}{8} \tan. \tfrac{1}{8} x + \&c.$$

This elegant expression for the reciprocal of an arc, has been otherwise found in ARITHMETIC *of Sines*, Art. 33, and in CONIC SECTIONS, Sect. vii.

By taking the fluxions repeatedly of both sides of this equation, we may find series for the reciprocal of the squares, and any higher powers of an arc.

40. From the few applications which have been given in this Section, it must appear, that the fluxional calculus is a powerful instrument in analytical inquiries. For as all quantities whatever may be treated by the elementary operations of addition, subtraction, multiplication, and division, by attributing to them the property of being variable, they become subject to another operation, namely, that by which their fluxions are taken.

It must also be obvious, that the use of the character dx is merely to shew, that the changes of magnitude of different functions are all referred to that of the variable quantity x, which, in a function of a determinate form, has the same relation to the function that a root has to its power.

Of the Different Orders of Fluxions.

41. In what has been already explained, we have established the important principle in analysis, that if u, any expression of calculation, be regarded as formed from, and depending upon, some quantity x, which is susceptible of all degrees of increase or decrease; then there is a certain quantity p, deducible from u by determinate rules, which is a limit to the ratio of the corresponding increments of u and x; and which we have called the fluxional co-efficient, originating from the function u.

Now, by applying the same hypothesis to p, that is, by comparing its increase or decrease with the corresponding increase or decrease of x, the function p will in like manner have its fluxional coefficient q, and this last will have its fluxional coefficient r, and so on.

Hence it follows, that corresponding to u, any function of x, there is a series of fluxional coefficients $p, q, r,$ &c. any one of which, after the first is deducible from that before it, as the first is from the original function, by the rules which have been given for finding the fluxion of a function. For example, if $u = x^n$, then by rule (A), $\frac{du}{dx} = n x^{n-1}$, therefore in this case $p = n x^{n-1}$, and since $dp = n(n-1) x^{n-2} dx$, rule (A,) therefore $q = \frac{dp}{dx} = n(n-1) x^{n-2}$. In like manner, $dq = n(n-1)(n-2) x^{n-3} dx$, and hence $r = \frac{dq}{dx} = n(n-1)(n-2) x^{n-3}$, and so on.

The relation that each of the fluxional coefficients $p, q, r,$ &c. stands in to the original function u, is indicated by calling p the fluxional coefficient of the *first order*, q that of the *second order*, r that of the *third order*, and so on; so that in the case of the function $u = x^n$, the fluxional coefficients of the first, second, and third order, resulting from the function, are

$$p = nx^{n-1},\ q = n(n-1)x^{n-2},\ r = n(n-1)(n-2)x^{n-3}.$$

42. The process by which the fluxional coefficients $p, q, r,$ &c. are to be determined from the function u, is indicated by the series of equations

$$p = \frac{du}{dx},\ q = \frac{dp}{dx},\ r = \frac{dq}{dx},\ \&c.$$

In these, the conventional symbol dx enters merely as a mark to indicate, that x is the variable basis of the function; therefore, in performing the operations, we may treat it as if it represented some constant quantity, and so we shall have

$$dq = \frac{d(dp)}{dx} = \frac{d\left\{d(du)\right\}}{dx.\,dx},$$

and, therefore,

$$p = \frac{du}{dx},\ q = \frac{d(du)}{dx.\,dx},\ r = \frac{d\left\{d(du)\right\}}{dx.\,dx.\,dx}$$

; but instead of repeating the letter d so often, it will be better to put $d^2 u$ for $d(du)$, and $d^3 u$ for $d\left\{d(du)\right\}$, and, in general, $d^n u$ for the ultimate result obtained by taking the fluxion of u, and again the fluxion of the first result, and so on, until the operation has been performed n times, always considering dx as constant. Also, instead of $dx.dx$, we may put $(dx)^2$, or still more simply, dx^2; and, in general, instead of the product of n factors, each $= dx$, we may put dx^n, we then have

$$p = \frac{du}{dx},\ q = \frac{d^2 u}{dx^2},\ r = \frac{d^3 u}{dx^3},\ \&c.$$

and hence again,

$$du = p\,dx,\ d^2 u = q\,dx^2,\ d^3 u = r\,dx^3,\ \&c.\ *$$

From the manner in which the series of quantities $p\,dx$, $q\,dx^2$, $r\,dx^3$, &c. are deduced from the function u, we may indicate their relation to it, by calling $p\,dx$ the *first fluxion* of u, and $q\,dx^2$ the *second fluxion* of u, and $r\,dx^3$ its *third fluxion*, and so on, so that the nth

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* The reader must be careful to give each of these three symbols, $d^n u$, $d u^n$ $d(u^n)$ its true meaning. The first indicates that the operation of finding the fluxion of u is to be performed n times; the second, that the result of the first operation is to be raised to the nth power; the third, that the fluxion of the nth power of u is to be taken.

Direct Method.

fluxion of u (denoted by $d^n u$) will be the fluxional coefficient of the nth order multiplied by the nth power of dx, that is by dx^n;* and, on the contrary, like as the fluxional coefficient of the first order is $\frac{du}{dx}$, the fluxional coefficient of the nth order will be $\frac{d^n u}{dx^n}$.

43. It has been proved, (art. 28.) that if u and v are two functions, which are equal for every value of x, then the fluxional coefficients of the first order derived from them will be equal, that is, $\frac{du}{dx}=\frac{dv}{dx}$: Now, as these expressions denote other functions of x, having the same property as the original functions, we must, in like manner, have $\frac{d\,\frac{(du)}{dx}}{dx}=\frac{d\,\frac{(dv)}{dx}}{dx}$, that is, $\frac{d^2u}{dx^2}=\frac{d^2v}{dx^2}$, so that not only will the fluxional coefficients of the first order be equal, but likewise those of the second and all higher orders.

As the equations

$$u=v,\ \frac{du}{dx}=\frac{dv}{dx},\quad \frac{d^2u}{dx^2}=\frac{d^2v}{dx^2},\ \text{\&c.}$$

may also be expressed thus,

$$u-v=0,\quad \frac{d(u-v)}{dx}=0,\quad \frac{d^2(u-v)}{dx^2}=0,\ \text{\&c.}$$

it appears that the same proposition may be expressed as follows: If X be such a function of x, that $X=0$, for all values of x whatever, then shall $\frac{dX}{dx}=0$, $\frac{d^2X}{dx^2}=0$, and universally $\frac{d^nX}{dx^n}=0$.

For example, if $X=\frac{2a}{x^2-a^2}-\frac{1}{x-a}+\frac{1}{x+a}$, an expression which is always $=0$; then,

$$\frac{dX}{dx}=\frac{-4ax}{(x^2-a^2)^2}+\frac{1}{(x-a)^2}-\frac{1}{(x+a)^2}=0,$$

$$\frac{d^2X}{dx^2}=\frac{4a^3+12ax^2}{(x^2-a^2)^3}+\frac{2}{(x-a)^3}-\frac{2}{(x+a)^3}=0,\ \text{\&c.}$$

44. The rules for finding the first fluxion of a function of x, are equally applicable to the second and higher fluxions.

Let $u=x^n$; then (rule (A)) $du=nx^{n-1}dx$. By considering dx as a constant quantity, we have $d(du)$, that is, $d^2u=n(n-1)x^{n-2}dx^2$. By proceeding in this manner, the successive fluxions of $u=x^n$ are

$$du=nx^{n-1}dx,$$
$$d^2u=n(n-1)x^{n-2}dx^2,$$
$$d^3u=n(n-1)(n-2)x^{n-3}dx^3,\ \text{\&c.}$$

From these expressions, it appears, that when n is a whole number, the fluxion of the nth order is a constant quantity, and therefore all the following fluxions vanish.

Let $u=\log. x$; then b, denoting the basis of the system, by rules (B) and (A), we get

$$du=\frac{dx}{x\,\mathrm{l.}(b)},\ d^2u=-\frac{dx^2}{x^2\,\mathrm{l.}(b)},\ d^3u=\frac{2dx^3}{x^3\,\mathrm{l.}(b)},\ \text{\&c.}$$

Let $u=e^x$, e being the basis of the Napierian system of logarithms; then, by rule (C),

$$du=dx\,e^x,\ d^2u=dx^2e^x,\ d^3u=dx^3e^x,\ \text{\&c.}$$

From these examples, it appears, that the functions $u=\log. x$, and $u=e^x$ have fluxions of all orders whatever. This will also be found to be true of the functions $u=\sin. x$, and $u=\cos. x$.

Of Fluxional Equations.

45. We have hitherto supposed that the expression whose fluxional coefficient is to be determined, was an *explicit* function of the variable quantity x, that is, a function of x of some given form. But it may be required to find the fluxional coefficient of y, an *implicit* function of x, the nature of which is expressed by an equation. For example, the relation of y to x may be expressed by the equation

$$y^2-2mxy+x^2-a^2=0.$$

In this particular case, by resolving the equation, we have

$$y=mx\pm\sqrt{\left\{a^2+(m^2-1)x^2\right\}};$$

as y is now an explicit function of x, its fluxion may be found by the rules already given. But the equation which expresses the relation of y to x may not admit of being resolved; and when this is the case, the fluxional coefficient must be determined upon principles which we are now to explain.

As we have denoted any expression of calculation composed of x and constant quantities by the symbol $f(x)$, we may, in like manner, denote any expression composed of x, y, and known quantities, by $f(x, y)$.

In this way, any equation, such as $y^2-2mxy+x^2-a^2=0$, expressing the relation between x and y, may be briefly indicated thus, $F(x,y)=0$. Now, although we should not be able to resolve the equation, we may be certain that y is expressible in some way or other by x: It may therefore be assumed that $y=X$, where X denotes some expression of calculation made up of x and known quantities. This value of y being put instead of it in the equation $F(x,y)=0$, it becomes $F(x,X)=0$, an equation involving only x and constant quantities: And as the equation $F(x,y)=0$ holds true for every possible value of x, so also must the equation $F(x,X)=0$: This must therefore be an identical equation, and consequently it will have the properties which (in art. 43.) have been proved to belong to such an equation: So that putting u to denote briefly the expression $F(x, X)$, or its equivalent $F(x,y)$, as we have $u=0$, we must have also $\frac{du}{dx}=0$, $\frac{d^2u}{dx^2}=0$, $\frac{d^3u}{dx^3}=0$, &c. expressions which mean that if the fluxion of $u=F(x,y)$, (considering y as a function of x) be found and divided by dx, the result will be $=0$; and again, if the fluxion of this quantity be found and divided by dx, this second result will be $=0$, and so on.

46. Let y be a function of x, of such a nature that

$$y^2+x^2=a^2,\ \text{or}$$
$$y^2+x^2-a^2=0,\qquad (1)$$

a being supposed a constant quantity. In this case,

$$u=y^2+x^2-a^2,$$

therefore, taking the fluxions and dividing by dx, we get

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* According to the notation hitherto used in this country, the second fluxion of u is indicated by the character $\ddot{u}$, its third fluxion by $\dddot{u}$ its fourth by $\ddddot{u}$. It is easy to see that the higher orders of fluxions must either be expressed with considerable typographical inconvenience, or the notation changed.

Direct Method.

$$\frac{du}{dx} = 2y\frac{dy}{dx} + 2x = 0;$$

Hence, $$\frac{dy}{dx} = -\frac{x}{y}. \qquad (2)$$

To determine the fluxional co-efficient of the second order, put $\frac{dy}{dx} = p$; then

$$\frac{du}{dx} = 2(yp + x).$$

As p is a function of y and x, and y is a function of x, therefore p is a function of x. Taking now the fluxions relatively to x, and dividing by dx, we have

$$\frac{d^2u}{dx^2} = 2(y\frac{dp}{dx} + p\frac{dy}{dx} + 1) = 0;$$

that is, because $p = \frac{dy}{dx}$, and $\frac{dp}{dx} = \frac{d^2y}{dx^2}$,

$$\frac{d^2u}{dx^2} = 2(y\frac{d^2y}{dx^2} + \frac{dy}{dx^2} + 1) = 0. \qquad (3)$$

This last equation gives us

$$\frac{d^2y}{dx^2} = -\frac{1}{y}\left(\frac{dy^2}{dx^2} + 1\right)$$

Or, since $\frac{dy}{dx} = -\frac{x}{y}$,

$$\frac{d^2y}{dx^2} = -\frac{x^2}{y^3} - \frac{1}{y} \qquad (4)$$

To determine the fluxional coefficient of the third order, we may put $\frac{d^2y}{dx^2} = \frac{dp}{dx} = q$, and then substituting p for $\frac{dy}{dx}$, equation (3) becomes

$$\frac{d^2u}{dx^2} = 2(yq + p^2 + 1) = 0.$$

By taking the fluxions of both sides of this equation, and considering that q and p are functions of x and y, and consequently of x, we shall have an equation involving, besides x and y, these quantities,

$$\frac{dq}{dx}, \frac{dp}{dx} = \frac{d^2y}{dx^2}, \; q = \frac{d^2y}{dx^2}, \text{ and } p = \frac{dy}{dx}.$$

The quantity $\frac{dq}{dx} = \frac{d^3y}{dx^3}$ is that to be determined; the other quantities $\frac{d^2y}{dx^2}$, and $\frac{dy}{dx}$, are expressed in equations (4) and (2) by means of x and y: Hence the value of $\frac{d^3y}{dx^3}$ may be found. And, by a like mode of proceeding, the fluxional coefficient of any order may be found.

This mode of determining the fluxional coefficients $\frac{dy}{dx}, \frac{d^2y}{dx^2}$, &c. is that indicated by the analysis (art. 45.) It evidently furnishes the following practical rule.

Take the fluxions of the terms of the equation, considering y as a function of x, and dividing by dx, the result will be a new equation, which serves to determine $\frac{dy}{dx}$. Again, take the fluxions of the terms of this new equation, considering y and $\frac{dy}{dx}$ as functions of x, and the result will be an equation involving $\frac{d^2y}{dx^2}$, and $\frac{dy}{dx}$, which, combined with the former equation, serves to determine $\frac{d^2y}{dx^2}$. A third equation may be formed from this by taking the fluxions, considering $\frac{d^2y}{dx^2}$, $\frac{dy}{dx}$ and y as functions of x, and this combined with the two former, gives the value of $\frac{d^3y}{dx^3}$, and so on to any number of equations whatever.

Direct Method.

Let the fluxional coefficients of the different orders be required, supposing y to be such a function of x that

$$y^2 - 2mxy + x^2 - a^2 = 0 \qquad (1)$$

In this case, by taking the fluxions, we have

$$(y - mx)dy - (my - x)dx = 0,$$

and hence

$$\frac{dy}{dx} = \frac{my - x}{y - mx}. \qquad (2)$$

From this expression, by again taking the fluxions, we find

$$\frac{d^2y}{dx^2} = \frac{(1-m^2)x}{(y-mx)^2}\frac{dy}{dx} - \frac{(1-m^2)y}{(y-mx)^2}; \qquad (3)$$

Or, substituting for $\frac{dy}{dx}$ its value as expressed by equation (2), and reducing,

$$\frac{d^2y}{dx^2} = -(1-m^2)\frac{y^2 - 2mxy + x^2}{(y-mx)^3}. \qquad (4)$$

If we take the fluxions of both sides of equation (3), considering $\frac{d^2y}{dx^2}$ and $\frac{dy}{dx}$ as functions of x, we shall have

$$\frac{d^3y}{dx^3} = P\frac{d^2y}{dx^2} + Q\frac{dy}{dx} + R \qquad (5)$$

Where P, Q and R denote certain expressions composed of x and y; by substituting for $\frac{d^2y}{dx^2}$ and $\frac{dy}{dx}$, their values given in equations (4) and (2), we may have $\frac{d^3y}{dx^3}$ expressed in terms of x and y.

47. The equations which may be deduced from any equation, such as $y^2 - 2mxy + x^2 - a^2 = 0$, by treating it as directed in the rule of last article, are called *Fluxional Equations*. The equation itself is called the *Primitive* equation. The fluxional equation, which gives the value of $\frac{dy}{dx}$ in terms of y and x, is said to be of the *First Order*. That which gives the value of $\frac{d^2y}{dx^2}$ in terms of $\frac{dy}{dx}$, y, and x, or else in terms of y and x only, is said to be of the *Second Order*; and so of the higher orders: Thus, from the primitive equation,

$$y^2 - 2mxy + x^2 - a^2 = 0,$$

we have found

$$\frac{dy}{dx} - \frac{my - x}{y - mx} = 0,$$

for the fluxional equation of the first order, and

$$\frac{d^2y}{dx^2} - \frac{(1-m^2)x}{(y-mx)^2}\frac{dy}{dx} + \frac{(1-m^2)y}{(y-mx)^2} = 0,$$

also $$\frac{d^2y}{dx^2} + (1-m^2)\frac{y^2 - 2mxy + x^2}{(y-mx)^3} = 0,$$

for the fluxional equations of the second order.

The fluxional equations of all orders like the primitive are identical.

48. The equation $y^2 - 2mxy + x^2 - a^2 = 0$ being of the

second degree, y will have two values corresponding to any given value of x, and as y enters into the expressions for the fluxional coefficients $\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$, &c. these will also have each two values. A like remark will apply to the fluxional coefficients derived from a primitive equation of any higher order; the number of values of y determining in every case that of the values of the fluxional coefficients into which it enters.

49. We have seen (art. 27.) that the constant quantities which enter into a function of a variable quantity in certain cases disappear from their fluxions. The same remark applies also to fluxional equations. For example, if $y^2 = ax + b$, the fluxion $2y\,dy = a\,dx$ belongs to every particular equation which can be formed from the equation $y^2 = ax + b$, by giving all possible values to b.

The fluxional equation may be also expressed independently of a, by eliminating this quantity by means of the two equations

$$y^2 = ax + b, \quad \frac{dy}{dx} = \frac{a}{2y}$$

we then find

$$\frac{dy}{dx} = \frac{y^2 - b}{2xy}.$$

This equation expresses a relation that subsists among the quantities x, y and $\frac{dy}{dx}$, independently of any particular value of a.

If the constant quantity which is eliminated is not of the first degree in the proposed equation, the result obtained will contain powers higher than the first of the fluxional coefficient $\frac{dy}{dx}$. For example, let the equation be

$$y^2 - 2ay + x^2 = a^2,$$

Hence, by taking the fluxions, we find

$$y\,dy - a\,dy + x\,dx = 0,$$

therefore $a = \frac{y\,dy + x\,dx}{dy}$.

This value of a being substituted in the proposed equation, we find, after proper reduction,

$$(x^2 - 2y^2)\frac{dy^2}{dx^2} - 4xy\frac{dy}{dx} - x^2 = 0.$$

This equation expresses the relation that ought to subsist between the variable quantity x, its function y and its fluxional coefficient $\frac{dy}{dx}$, independently of any particular value of a.

By resolving the equation $y^2 - 2ay + x^2 = a^2$, in respect of a, we have

$$a = -y \pm \sqrt{(2y^2 + x^2)}.$$

As a is now separated from the variable quantities, it will disappear in taking the fluxion: accordingly we find

$$-dy \pm \frac{2y\,dy + x\,dx}{\sqrt{(2y^2 + x^2)}} = 0.$$

When this expression is freed from the radical sign, it will appear to be the same as we have found by elimination.

50. Any number of constant quantities whatever, contained in an equation, may be made to disappear, by taking the fluxions as often as there are quantities to be exterminated.

Let $y^2 = m(a^2 - x^2)$: by taking the fluxions we find $y\frac{dy}{dx} = -mx$. Taking now the fluxions a second time, we get $y\frac{d^2y}{dx^2} + \frac{dy^2}{dx^2} = -m$; this value of $-m$ being substituted in the former equation, it becomes

$$y\frac{dy}{dx} - x\frac{dy^2}{dx^2} - xy\frac{d^2y}{dx^2} = 0,$$

a result which is independent of the two constant quantities m and a.

Investigation of Taylor's Theorem, and its Application to the Developement of Functions.

51. The principle established in art. 28, and illustrated by various examples in art. 36, 37, and 38, leads immediately to an important application of the fluxional calculus, namely, the developement of functions into series.

Let us consider, in the first place, the particular function x^n, x being supposed variable, and n any constant quantity. We have found (art. 7.) that when x becomes $x + h$, so that x^n becomes $(x+h)^n$, then

$$(x+h)^n = x^n + (nx^{n-1} + \mathrm{H})h,$$

where H is a function of x and h, which vanishes when $h = 0$. As x and h are quantities which we suppose to be entirely independent of each other, this is an identical equation of the same nature as the equation $(x+h)^3 = x^3 + (3x^2 + 3xh + h^2)h$, and will hold true, whatever values we give to x and h. We may therefore, instead of h put $k - x$, where k denotes also a quantity independent of x. By this substitution, $(x+h)^n$, the first member of the equation becomes k^n; but as the form of the function H is unknown, we cannot actually make the substitution in all the terms of the second member; we may however suppose, that if it were made, the quantity $nx^{n-1} + \mathrm{H}$ would become X, a function of x and k, and then the equation will be

$$k^n = x^n + \mathrm{X}(k - x)$$

an identical equation involving two indeterminate quantities x and k, which, being quite independent of each other, we may regard k one of the two, as constant, and still the equation will be true whatever values we give to x the other quantity, which may be now considered as alone variable. This equation may therefore be treated exactly as the identical equations we have considered in art. 36. that is, we may take the fluxions of all the terms, and after dividing by dx, we shall have a new identical equation; and this equation may be treated like the former, and so on as often as we please. Accordingly, taking the fluxions, considering k as constant, and observing that $d(x^n) = nx^{n-1}dx$ (art. 26.) and that $d\left\{\mathrm{X}(k-x)\right\} = (k-x)d\mathrm{X} - \mathrm{X}\,dx$ (art. 29. and 31.) we have

$$0 = nx^{n-1}dx - \mathrm{X}\,dx + (k-x)\,d\mathrm{X},$$

and hence, dividing by dx, and transposing X, we get

$$\mathrm{X} = nx^{n-1} + (k-x)\frac{d\mathrm{X}}{dx},$$

a new identical equation, involving x and k. We next take the fluxions of the terms of this equation exactly as before, considering k and dx as constant quantities, and get

$$d\mathrm{X} = n(n-1)x^{n-2}dx - d\mathrm{X} + (k-x)\frac{d^2\mathrm{X}}{dx}.$$

And hence we find, after dividing by dx,

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$$2\frac{dX}{dx}=n(n-1)x^{n-2}+(k-x)\frac{d^2X}{dx^2}.$$

This is a new identical equation, which must hold true for every value of x. From this equation we may derive another, just as we found the last from that before it, and so on. Thus a series of identical equations will be found, which, with the original equation from which they have been derived, will stand thus

$$k^n=x^n+(k-x)X,$$

$$X=nx^{n-1}+(k-x)\frac{dX}{dx},$$

$$2\frac{dX}{dx}=n(n-1)x^{n-2}+(k-x)\frac{d^2X}{dx^2}$$

$$3\frac{d^2X}{dx^2}=n(n-1)(n-2)x^{n-3}+(k-x)\frac{d^3X}{x^3},$$

$$4\frac{d^3X}{dx^3}=n(n-1)(n-2)(n-3)x^{n-4}+(k-x)\frac{d^4X}{dx^4},$$

&c.

From these equations, by eliminating one after another, the functions $\frac{dX}{dx}$, $\frac{d^2X}{dx^2}$, $\frac{d^3X}{dx^3}$, &c. the following series of successive values of X is obtained.

$$X=nx^{n-1}+(k-x)\frac{dX}{dx}$$

$$X=nx^{n-1}+\frac{n(n-1)}{2}x^{n-2}(k-x)$$
$$+\frac{(k-x)^2}{2}\cdot\frac{d^2X}{dx^2},$$

$$X=nx^{n-1}+\frac{n(n-1)}{2}x^{n-2}(k-x)$$
$$+\frac{n(n-)(n-2)}{2.3}x^{n-3}(k-x)^2+\frac{(k-x)^3}{2.3}\cdot\frac{d^3X}{dx^3},$$

&c.

Hence, by substituting these expressions for X in the equation

$$k^n=x^n+X(k-x),$$

we find

$$k^n=x^n+nx^{n-1}(k-x)+(k-x)^2\frac{dX}{dx},$$

$$k^n=x^n+nx^{n-1}(k-x)+\frac{n(n-1)}{2}x^{n-2}(k-x)^2$$
$$+\frac{(k-x)^3}{2}\cdot\frac{d^2X}{dx^2},$$

&c.

And again, by putting $x+h$ instead of k, and h for $k-x$, but retaining still the hypothesis that the fluxional functions $\frac{dX}{dx}$, $\frac{d^2X}{dx^2}$, &c. are functions of x and k, in which k is constant, we have

$$(x+h)^n=x^n+nx^{n-1}h+h^2\frac{dX}{dx},$$

$$(x+h)^n=x^n+nx^{-1}h+\frac{n(n-1)}{2}x^{n-2}h^2$$
$$+\frac{h^3}{2}\cdot\frac{d^2X}{dx^2}.$$

And in general, supposing the series to be continued to m terms, (without reckoning the term that contains the fluxional expression),

$$(x+h)^n=x^n+nx^{n-1}h+\frac{n(n-1)}{2}x^{n-2}h^2$$
$$+\frac{n(n-1)(n-2)}{2.3}x^{n-3}h^3+,\ \&c.$$
$$+\frac{h^m}{2.3\ldots.(m-1)}\cdot\frac{d^{m-1}X}{dx^{m-1}}.$$

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If we suppose this series to be continued indefinitely, then we have the binomial theorem in its common form (ALGEBRA, art. 316—322.), and in this case the quantity

$$\frac{h^m}{2.3\ldots m-1}\cdot\frac{d^{m-1}X}{dx^{m-1}}$$

expresses the amount of all the terms of the series after the first m terms. For example, $h^2\frac{dX}{dx}$ expresses the amount of all the terms following the second; and $\frac{h^3}{2}\cdot\frac{d^2X}{dx^2}$ expresses the amount of all after the third, and so on.

When n is a whole number the series terminates, because then all the terms after the $(n+1)$th term vanish. In this case the expression $\frac{d^{m-1}X}{dx^{m-1}}$ or $\frac{d^nX}{dx^n}$ ought to be $=0$. To verify the truth of this conclusion, we must recollect, that because $k^n=x^n+X(k-x)$; therefore $X=\frac{k^n-x^n}{k-x}$; now, when n is a whole number, the numerator is exactly divisible by the denominator, so that

$$X=k^{n-1}+k^{n-2}x+k^{n-3}x^2\ldots+kx^{n-2}+x^{n-1};$$

hence, considering k as constant, we have

$$\frac{dX}{dx}=\begin{cases}k^{n-2}+2k^{n-3}x+3k^{n-4}x^2\ldots\\+(n-2)kx^{n-3}+(n-1)x^{n-2};\end{cases}$$

$$\frac{d^2X}{dx^2}=\begin{cases}2k^{n-3}+2.3k^{n-4}x\ldots\\+(n-2)(n-3)x^{n-4}+(n-1)(n-2)x^{n-3},\end{cases}$$

&c.

By proceeding in this manner, we may express all the functions $\frac{dX}{dx}$, $\frac{d^2X}{dx^2}$, &c. in terms of k and x; and it is manifest, that the series which expresses each, will have one term fewer than the series which expresses that before it, because of the constant quantities k^{n-1}, k^{n-2}, &c. which have their fluxions $=0$. As the series which expresses X has n terms, that which expresses $\frac{dX}{dx}$ will consist of $n-1$ terms, and that which expresses $\frac{d^2X}{dx^2}$ will consist of $n-2$ terms, and so on to the value of $\frac{d^{n-1}X}{dx^{n-1}}$, which will consist of a single term, viz.

$$\left\{(n-1)(n-2)(n-3)\ldots\text{to }(n-1)\text{ factors}\right\}x^{n-1-(n-1)}$$
$$=1.2.3.4\ldots\text{ to }(n-1).$$

As this is a constant quantity, its fluxion will be $=0$, therefore $\frac{d^nX}{dx^n}$ will be $=0$, as we had concluded that it ought to be.

When n is a fraction or negative, then $X=\frac{k^n-x^n}{k-x}$ is still a fraction, when the numerator and denominator are each divided by their common factor. In this case, whatever be the number m, the expression $\frac{d^mX}{dx^m}$ can never be $=0$: still, however, it may be calculated. For example, if $n=\frac{1}{2}$, then $X=\frac{k^{\frac{1}{2}}-x^{\frac{1}{2}}}{k-x}=\frac{1}{k^{\frac{1}{2}}+x^{\frac{1}{2}}}$, therefore,

$$\frac{dX}{dx}=\frac{-1}{2x^{\frac{1}{2}}(k^{\frac{1}{2}}+x^{\frac{1}{2}})^2};\ \frac{d^2X}{dx^2}=\frac{k^{\frac{1}{2}}+3x^{\frac{1}{2}}}{4x^{\frac{1}{2}}(k^{\frac{1}{2}}+x^{\frac{1}{2}})^3},\ \&c.$$

From the first of these expressions, we find

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$$(x+h)^{\frac{1}{2}}=x^{\frac{1}{2}}+\frac{h}{2x^{\frac{1}{2}}}-\frac{h^2}{2x^{\frac{1}{2}}\left\{(x+h)^{\frac{1}{2}}+x^{\frac{1}{2}}\right\}^2};$$

and, in like manner, we may develope $(x+h)^{\frac{1}{2}}$ into as many terms as we please. This expression, and every other found by this theorem, is merely an identical equation, as will appear by reducing all the terms to a common denominator, for then it becomes $(x+h)^{\frac{1}{2}}=(x+h)^{\frac{1}{2}}$.

52. We might develope each of the functions, log. x, a^x, sin. x, cos. x, into series, in the same manner as we have developed $(x+h)^n$; but these, and every other function whatever of the form $f(x+h)$, where x and h are indeterminate quantities independent of each other, may be included in one general formula, which we shall now investigate.

Let $f(x)$, any function of a variable quantity x, be represented by u, so that we have $f(x)=u$, then, when x changes its value, and becomes $x+h$, we have seen (art. 19) that

$$\begin{aligned}f(x+h)&=fx+(p+\mathrm{H})h\\&=u+(p+\mathrm{H})h,\end{aligned}$$

where p is a function of x that is independent of h; and H is a function of x and h, which vanishes when $h=0$. Retracing now the substitutions and operations of article 51, let $k=x+h$; from which it follows that $h=k-x$; and let X be the value of $p+\mathrm{H}$, when $k-x$ is substituted in it for h. The equation thus becomes

$$f(k)=u+\mathrm{X}(k-x).$$

As k is independent of x, the expression $f(k)$ is to be considered as constant. u is a function of x only, and X is a function of x and k. Taking now the fluxions of the quantities u and $\mathrm{X}(k-x)$ relatively to x, and dividing by dx, we get, in the first place,

$$0=\frac{du}{dx}-\mathrm{X}+(k-x)\frac{d\mathrm{X}}{dx},$$

and hence again,

$$\mathrm{X}=\frac{du}{dx}+(k-x)\frac{d\mathrm{X}}{dx}.$$

Considering now dx as a constant quantity, and taking the fluxions repeatedly, and dividing by dx as before, we find, as in art. 51,

$$\begin{aligned}2\,\frac{d\mathrm{X}}{dx}&=\frac{d^2u}{dx^2}+(k-x)\frac{d^2\mathrm{X}}{dx^2},\\3\,\frac{d^2\mathrm{X}}{dx^2}&=\frac{d^3u}{dx^3}+(k-x)\frac{d^3\mathrm{X}}{dx^3}\\4\,\frac{d^3\mathrm{X}}{dx^3}&=\frac{d^4u}{dx^4}+(k-x)\frac{d^4\mathrm{X}}{dx^4},\\&\text{\&c.}\end{aligned}$$

Hence, we have this series of equations

$$\begin{aligned}\mathrm{X}&=\frac{du}{dx}+(k-x)\frac{d\mathrm{X}}{dx},\\\frac{d\mathrm{X}}{dx}&=\tfrac{1}{2}\frac{d^2u}{dx^2}+\tfrac{1}{2}(k-x)\frac{d^2\mathrm{X}}{dx^2},\\\frac{d^2\mathrm{X}}{dx^2}&=\tfrac{1}{3}\frac{d^3u}{dx^3}+\tfrac{1}{3}(k-x)\frac{d^3\mathrm{X}}{dx^3},\\\frac{d^3\mathrm{X}}{dx^3}&=\tfrac{1}{4}\frac{d^4u}{dx^4}+\tfrac{1}{4}(k-x)\frac{d^4\mathrm{X}}{dx^4}.\\&\text{\&c.}\end{aligned}$$

These equations, when combined with the equation $f(k)=u+\mathrm{X}(k-x)$, give us

$$\begin{aligned}fk&=u+\frac{du}{dx}(k-x)+\frac{d\mathrm{X}}{dx}(k-x)^2,\\fk&=u+\frac{du}{dx}(k-x)+\frac{d^2u}{dx^2}\frac{(k-x)^2}{2}\\&\quad+\frac{d^2\mathrm{X}}{dx^2}\frac{(k-x)^3}{2};\\&\text{\&c.}\end{aligned}$$

and hence again, by substituting $x+h$ for k, but still retaining k in the function X, so that

$$\mathrm{X}=\frac{f(k)-u}{k-x}=\frac{f(k)-f(x)}{k-x},$$

where k is to be considered as a constant quantity, and x alone as variable, we have

$$\begin{aligned}f(x+h)&=u+\mathrm{X}h,\\f(x+h)&=u+\frac{du}{dx}h+\frac{d\mathrm{X}}{dx}h^2,\\f(x+h)&=u+\frac{du}{dx}h+\frac{d^2u}{dx^2}\frac{h^2}{2}+\frac{d^2\mathrm{X}}{dx^2}\frac{h^3}{2},\\f(x+h)&=u+\frac{du}{dx}h+\frac{d^2u}{dx^2}\frac{h^2}{2}+\frac{d^3u}{dx^3}\frac{h^3}{2.3}\\&\quad+\frac{d^3\mathrm{X}}{dx^3}\frac{h^4}{2.3}.\end{aligned}$$

If we suppose the series to proceed *ad infinitum*, then, without paying any regard to the expression $\frac{d^m\mathrm{X}}{dx^m}$, which enters into each finite developement of the function, we have

$$\begin{aligned}f(x+h)&=u+\frac{du}{dx}h+\frac{d^2u}{dx^2}\frac{h^2}{2}+\frac{d^3u}{dx^3}\frac{h^3}{2.3}\\&\quad+\frac{d^4u}{dx^4}\frac{h^4}{2.3.4},+\text{\&c.}\end{aligned}$$

This formula, remarkable for its elegance and simplicity, was first found by Dr Taylor, an eminent English mathematician, who published it in a work called *Methodus Incrementorum*, about the year 1716, and is commonly called Taylor's *Theorem*. Sir Isaac Newton gave a similar formula in his *Principia*, where he treats of the theory of comets, but it is applicable to a series of quantities having finite differences. Newton's formula becomes Taylor's theorem, when the differences are indefinitely small. This theorem has considerably excited the attention of mathematicians ever since the late M. Lagrange proposed to make it the basis of the fluxional or differential calculus, first in the Memoirs of the Berlin Academy for 1772, and afterwards in his *Theorie des Fonctions Analytiques*. The demonstration of it given here, is taken from a Memoir by M. Ampère, published in the thirteenth *Cahier* of the *Journal de l'Ecole Polytechnique*. It is simple and very elegant. Lagrange has also given an elegant demonstration, which has been improved by M. Poisson, and is now equally complete as that which we have here adopted, but more diffuse.

53. We shall now apply Taylor's theorem to the developement of the five elementary functions, which have so often come under our consideration.

1st. Let $f(x)=u=x^n$, then, (rule (A) art. 26.),

$$\begin{aligned}\frac{du}{dx}&=nx^{n-1},\\\frac{d^2u}{dx^2}&=n(n-1)x^{n-2},\\\frac{d^3u}{dx^3}&=n(n-1)(n-2)x^{n-3},\end{aligned}$$

&c.

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56. In the examples to which we have applied Maclaurin's theorem, the quantities U, U′, &c. have all finite values. If in any case one or more of them have an infinite value, we may conclude that the function does not admit of being expressed by a series, the terms of which are positive integer powers of x. The function $u = \text{l}.(x)$ is of this nature; for, from it we get $\frac{du}{dx} = \frac{1}{x}$, $\frac{d^2u}{dx^2} = -\frac{1}{x^2}$, $\frac{d^3u}{dx^3} = \frac{2}{x^3}$, &c. The supposition that $x = 0$ renders $\frac{du}{dx} = \frac{1}{0} =$ an infinite quantity; in like manner the quantities $\frac{d^2u}{dx^2}$, $\frac{d^3u}{dx^3}$, &c. become all infinite as well as the function u itself.

The quantities denoted by the symbols $\frac{du}{dx}$, $\frac{d^2u}{dx^2}$, &c. only become infinite, however, when particular values are given to x; therefore it will always be possible, by Taylor's theorem, to develope any function $f(x+h)$ into a series proceeding by the integer and positive powers of h, provided we suppose x to be an indeterminate quantity; when, by giving it a determinate value, the coefficients of h become infinite, it may be concluded, that, although in general the function may be developed into a series, the terms of which contain only the integer and positive powers of h, in that particular case, it will not admit of being so expressed. For example, let $u = b + (x-a)^{\frac{1}{2}}$; then, when x becomes $x+h$, we have $b + (x+h-a)^{\frac{1}{2}}$ for the new value or the second state of the function; and because in this case $\frac{du}{dx} = \frac{1}{2(x-a)^{\frac{1}{2}}}$, $\frac{d^2u}{dx^2} = -\frac{1}{4(x-a)^{\frac{3}{2}}}$, &c. by Taylor's theorem, we have,

$$b + (x+h-a)^{\frac{1}{2}} = b + (x-a)^{\frac{1}{2}} + \frac{1}{2(x-a)^{\frac{1}{2}}}h$$
$$+ \frac{1}{8(x-a)^{\frac{3}{2}}}h^2 + \&c.$$

In the particular case of $x = a$, or $x - a = 0$, the quantity to be developed, viz. $b + (x+h-a)^{\frac{1}{2}}$, becomes $b + h^{\frac{1}{2}}$; an expression containing a fractional power of h, and which has the twofold value $b + \sqrt{h}$ and $b - \sqrt{h}$, because the sign of a square root may be taken either + or —: As the developement contains only positive integer powers of h, relatively to this quantity, it can only have a single value, and therefore it is impossible that it should express the function in this particular case. Accordingly, when we make $x = a$ in the developement, its first term $u = b + (x-a)^{\frac{1}{2}}$ becomes b; but the coefficient of its second term, viz. $\frac{du}{dx} = \frac{1}{2(x-a)^{\frac{1}{2}}}$, becomes $\frac{1}{2(0)^{\frac{1}{2}}}$, a quantity infinitely great, and the same is true also of the coefficients of the third and following terms. Thus the analytical fact, that the developement cannot in this particular case represent the function, is indicated by its terms failing to express any thing definite. If, however, we give to x any value, except that of $x = a$, the function is correctly expressed by its developement.

Next, let the function be $u = \frac{b}{(x-a)^2}$; in this case, $\frac{du}{dx} = -\frac{2b}{(x-a)^3}$, $\frac{d^2u}{dx^2} = \frac{6b}{(x-a)^4}$, &c. therefore the general developement of $\frac{b}{(x+h-a)^2}$ (the second state of the function) is

$$\frac{b}{(x-a)^2} - \frac{2b}{(x-a)^3}h + \frac{3b}{(x-a)^4}h^2 - \&c.$$

In the particular case of $x = a$, every term of the developement becomes infinite; but then the value of the quantity indicated by the developement is $\frac{b}{h^2} = bh^{-2}$, an expression in which the exponent of h is negative: As the developement contains only positive powers of h, it could not express the new value of the function in this particular case. When x has any other value, the general developement will always hold true.

As a general formula commonly contains all individual cases, it has been regarded as in some measure a paradox in analysis, that the general developement of a function of a variable quantity should not apply to every particular value of that quantity; and in such cases, it is usual to say that Taylor's theorem *fails*, that is, in its application. Lagrange first cleared up this point, and shewed that when, by giving a particular value to x, the new state of the function contains terms of the form $\text{P}h^{-n}$ or $\text{Q}h^{\frac{m}{n}}$, that is, negative or fractional powers of h, then, from the very nature of the calculus, all the coefficients of the general developement, after a certain term, will become infinite. On the other hand, when a particular value of x renders the coefficients infinite, we may conclude that the developement ought, in that particular case, to contain fractional or negative powers of h.

Of Vanishing Fractions, &c.

57. A vanishing fraction is a fractional function of a variable quantity x of such a form, that its numerator and denominator become both $= 0$ when a particular value is given to x. Such, for example, is this, $\frac{x^2 - a^2}{x - a}$, which when $x = a$ becomes $\frac{0}{0}$; however, by remarking that $x^2 - a^2 = (x-a)(x+a)$, it will appear that $\frac{x^2 - a^2}{x - a} = x + a$, so that the value of the fraction when $x = a$, is in fact $a + a = 2a$, hence it appears that the fraction has in this case a real assignable value; and we also see that it assumes the form $\frac{0}{0}$ only because its numerator and denominator have a common factor, which is then $= 0$.

The fraction $\frac{x^3 - x^2a - xa^2 + a^3}{ax - a^2}$ has also the property of becoming $\frac{0}{0}$, when $x = a$: The numerator and denominator have a common divisor $x - a$, and this being taken out of both, the fraction is changed to $\frac{x^2 - a^2}{a}$: Upon the supposition that $x = a$, this last quantity becomes manifestly $= 0$. Therefore, when $x = a$, the fraction $\frac{x^3 - x^2a - xa^2 + x^3}{ax - a^2}$ becomes $= 0$.

Again, this other fraction $\frac{ax-a^2}{x^2-2ax+a^2}$ becomes $\frac{0}{0}$ when $x=a$; but by taking the common divisor $x-a$ out of the numerator and denominator, the fraction is changed to $\frac{a}{x-a}$; and this expression when $x=a$ becomes $\frac{a}{0}$ an infinite quantity.

Hence we see that a vanishing fraction may in some cases have a finite value, and that in others it may be nothing, or infinite; but in every case its value may be determined by freeing the numerator and denominator from the factors common to both. When the terms of the fraction are rational functions of x, this may be done by finding their common measure, as is taught in ALGEBRA, art. 72. But when they are irrational or transcendental quantities, this method fails.

58. Let $\frac{P}{Q}$ denote generally a fraction, the terms of which P and Q are functions of x, that vanish when $x=a$, some given quantity. Suppose x to become $x+h$, then, by Taylor's theorem, P becomes $P+\frac{dP}{dx}h+\frac{d^2P}{dx^2}\frac{h^2}{2}+\&c.$ and Q becomes $Q+\frac{dQ}{dx}h+\frac{d^2Q}{dx^2}\frac{h^2}{2}+\&c.$ and the fraction becomes

$$\frac{P+\frac{dP}{dx}h+\frac{d^2P}{dx^2}\frac{h^2}{2}+\&c.}{Q+\frac{dQ}{dx}h+\frac{d^2Q}{dx^2}\frac{h^2}{2}+\&c.}$$

Let us denote the fluxional coefficients $\frac{dP}{dx}$, $\frac{d^2P}{dx^2}$ &c. briefly by P', P'', &c. and $\frac{dQ}{dx}$, $\frac{d^2Q}{dx^2}$, &c. by Q', Q'', &c. then observing that when $x=a$, $P=0$, $Q=0$, we have, after dividing by h,

$$\frac{P'+\frac{1}{2}P''h+\&c.}{Q'+\frac{1}{2}Q''h+\&c.}$$

for the new value of the fraction. If we make $h=0$, this expression becomes simply $\frac{P'}{Q'}$, which must be the value of the fraction $\frac{P}{Q}$, when $x=a$, because it is evidently the same thing to suppose first, that $x=x+h$, and afterwards that $x=a$ and $h=0$, as to suppose at once that $x=a$. If it happen that one of the two quantities P', Q', is equal to 0, then the fraction $\frac{P}{Q}$ is either nothing, or infinite; but if both are $=0$, then, after rejecting P' and Q' from the general expression, and dividing again by h, we have $\frac{P''}{Q''}$ for the value of the fraction, in the case of $x=a$; and so on. Hence this rule.

To find the value of $\frac{P}{Q}$, a fraction which becomes $\frac{0}{0}$ when $x=a$. Divide the fluxion of the numerator by that of the denominator, let the result be $\frac{P'}{Q'}$; then if this expression does not become $\frac{0}{0}$, when a is substituted for x, it is the value sought; but if it does treat this fraction in all respects as the other was treated, deducing from it a new fraction $\frac{P''}{Q''}$, and proceed in this manner, until an expression be found which does not become $\frac{0}{0}$ by the substitution of a for x; and the first expression that occurs having this property is the value sought.

Ex. 1. The sum of n terms of the series $1+x+x^2+x^3+\&c.$ is $\frac{x^n-1}{x-1}$. If we suppose $x=1$, this expression becomes $\frac{0}{0}$. It is required to find in that case its value. Here $P=x^n-1$, $Q=x-1$, therefore $dP=nx^{n-1}dx$, $dQ=dx$, and $\frac{dP}{dQ}=\frac{nx^{n-1}}{1}=\frac{P'}{Q'}$. This expression, when 1 is put for x, becomes $\frac{n}{1}=n$, which is the value sought, as is otherwise sufficiently evident.

Ex. 2. Let the fraction be $\frac{ax^2+ac^2-2acx}{bx^2-2bcx+bc^2}$, which becomes $\frac{0}{0}$ when $x=c$. In this case,

$$dP=(2ax-2ac)\,dx;\ dQ=(2bx-2bc)\,dx,$$

$$\frac{dP}{dQ}=\frac{ax-ac}{bx-bc}=\frac{P'}{Q'}.$$

This fraction $\frac{P'}{Q'}$, becomes also $\frac{0}{0}$, when $x=c$, therefore, proceeding as before, $dP'=a\,dx$; $dQ'=b\,dx$; and $\frac{dP'}{dQ'}=\frac{a}{b}$, which is the value sought.

Ex. 3. The fraction $\frac{a^x-b^x}{x}$ becomes $\frac{0}{0}$ when $x=0$; Here

$$dP=\left\{a^x\,\mathrm{l.}(a)-b^x\,\mathrm{l.}(b)\right\}dx;\ dQ=dx;$$

$$\frac{dP}{dQ}=\frac{a^x\,\mathrm{l.}(a)-b^x\,\mathrm{l.}(b)}{1}=\frac{P'}{Q'};$$

when $x=0$, $\frac{P'}{Q'}$ becomes $\mathrm{l.}(a)-\mathrm{l.}(b)=\mathrm{l.}\left(\frac{a}{b}\right)$, which is the value required.

59. The rule of last article will not in general apply, if Taylor's theorem does not give the developements of the functions P, Q in the case of $x=a$. When this happens, we may substitute $a+h$, instead of x, in the fraction $\frac{P}{Q}$, and develope the numerator and denominator into ascending series of the form $Ah^m+Bh^n+Ch^p+\&c.$ $A'h^{m'}+B'h^{n'}+C'h^{p'}+\&c.$ We have then, instead of $\frac{P}{Q}$, this other fraction,

$$\frac{Ah^m+Bh^n+Ch^p+\&c.}{A'h^{m'}+B'h^{n'}+C'h^{p'}+\&c.};$$

or, dividing the numerator and denominator by $h^{m'}$,

$$\frac{Ah^{m-m'}+Bh^{n-m'}+Ch^{p-m'}+\&c.}{A'+B'h^{n'-m'}+Ch^{p'-m'}+\&c.}.$$

Under this form, it is easy to see, that if m be greater than m', the supposition that $h=0$, makes the fraction $=0$; and that if $m=m'$, the same supposition reduces the fraction to $\frac{A}{A'}$; because whatever be the value of h, $h^{m-m'}=h^0=1$; lastly, if m be less than m', so that $m-m'$ is negative, then, when $h=0$, the fraction becomes infinite. Hence this rule.

Seek the first terms of the ascending series, which are the developements of the numerator, and denominator when $a+h$ is substituted in them instead of x. Reduce to its lowest terms the new fraction formed from these first terms, and then make $h=0$; the result will be the value of the fraction when $x=a$: And this rule will apply in every case.

EXAMPLE. Let the fraction be

$$\frac{x^3-4ax^2+7a^2x-2a^3-2a^2\sqrt{(2ax-a^2)}}{x^2-2ax-a^2+2a\sqrt{(2ax-x^2)}},$$

and let its value be sought when $x=a$. When $a+h$ is substituted for x, the fraction becomes

$$\frac{2a^3+2a^2h-ah^2+h^3-2a^2\sqrt{(a^2+2ah)}}{-2a^2+h^2+2a\sqrt{(a^2-h^2)}}.$$

Now, by the binomial theorem,

$$\sqrt{(a^2+2ah)}=a+h-\frac{h^2}{2a}+\frac{h^3}{2a^2}-\frac{5h^4}{8a^3}+\&c.$$

$$\sqrt{(a^2-h^2)}=a-\frac{h^2}{2a}-\frac{h^4}{8a^3}-\&c.$$

When these series are substituted for the radical quantities, and h is made $=0$, we get $-5a$ for the value of the fraction.

60. If P and Q are functions of x, such that when $x=a$, then $\mathrm{P}=0$, and $\mathrm{Q}=$ infinity, which is expressed by the character ∞, it may be proposed to find the value of the product PQ, in that particular case. Put $\mathrm{R}=\frac{1}{\mathrm{Q}}$; then the value of x, which renders Q infinite, will make $\mathrm{R}=0$; and as $\mathrm{PQ}=\frac{\mathrm{P}}{\mathrm{R}}$, the value of x, which makes $\mathrm{PQ}=0\times\infty$, will make $\frac{\mathrm{P}}{\mathrm{R}}=\frac{0}{0}$. The problem may therefore be resolved by the rules of art. 58, and art. 59.

Ex. Supposing π to represent a semicircle, and x any arc, the expression $(1-x)\times\tan.(\frac{1}{2}\pi x)$ becomes $0\times\infty$ when $x=1$. Here $\mathrm{P}=1-x$, $\mathrm{Q}=\tan.(\frac{1}{2}\pi x)$, $\mathrm{R}=\frac{1}{\mathrm{Q}}=\cot.(\frac{1}{2}\pi x)$, and $\frac{\mathrm{P}}{\mathrm{R}}=\frac{1-x}{\cot.(\frac{1}{2}\pi x)}$; when $x=1$ this expression becomes $\frac{0}{0}$. Now $d\mathrm{P}=-dx$, and $d\mathrm{R}=-\frac{\frac{1}{2}\pi dx}{\sin.^2(\frac{1}{2}\pi x)}$ (art. 34). Hence in the case of $x=1$, we have $\frac{d\mathrm{P}}{d\mathrm{R}}=\frac{2}{\pi}$ for the value of the expression $(1-x)\tan.(\frac{1}{2}\pi x)$.

Of the Greatest and Least Values of a Function.

61. If y be a function of a variable quantity x, of such a nature, that x being supposed to increase or decrease continually, y increases to a certain value, but afterwards decreases: when y has that extreme value, it is said to be a *maximum*. And, on the other hand, if y decrease to a certain value, and then increase; when it has that particular value, it is said to be a *minimum*. The co-ordinates of a plane curve may conveniently be employed to indicate the relative changes of magnitude in a variable quantity, and any function of that quantity. In Plate CCLV. Fig. 1. let CQD be a curve, referred to an axis AB, and such that, if any abscissa AP be taken to represent x; the corresponding ordinate PQ may represent the function y. Also, let us suppose that the curve recedes from the axis in that part of it between C and Q′, and then approaches between Q′ and Q″; and again recedes between Q″ and Q‴, and returns towards the axis in the branch QD; and so on. Suppose now the ordinate PQ to move parallel to itself from C along the axis, it will increase from C to Q′: in the position P′Q′, it will be a *maximum*; then it will decrease, and in the position P″Q″ it will be a *minimum*; afterwards it will increase, and again be a *maximum* in the position P‴Q‴, and so on; so that it may have various *maxima* and *minima* unequal among themselves, the essential character of a *maximum* consisting in this, *that the values which immediately precede, or which immediately follow it, are smaller; on the contrary, the minimum is exceeded by the values which immediately precede and follow it.*

PLATE CCLV. Fig. 1.

62. It is an immediate consequence of this characteristic property, that if a be the value of x, which renders y a *maximum* or *minimum*, and if $a+h$, and also $a-h$ be substituted instead of x in the function, then both results will be less than a *maximum* value of y, but they will be both greater than a *minimum* value. Now, whatever be the value of x, if $x+h$ and $x-h$ be substituted instead of x in the function y; by Taylor's theorem, (art. 52.) it will become in the one case,

$$y+\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}+\frac{d^3y}{dx^3}\frac{h^3}{2.3}+\&c.$$

and in the other,

$$y-\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}-\frac{d^3y}{dx^3}\frac{h^2}{2.3}+\&c.$$

therefore, when a is substituted for x in these two developements, they will both be less than a *maximum* value of the function, and both greater than a *minimum* value; but when this substitution is made, the first term y becomes, by hypothesis, the *maximum* or *minimum* value. Therefore, in the case of a maximum, we must have

$$y+\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}+\frac{d^3y}{dx^3}\frac{h^3}{2.3}+\&c.\angle y,$$

$$y-\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}-\frac{d^3y}{dx^3}\frac{h^3}{2.3}+\&c.\angle y;$$

and taking y from each side,

(A)

$$+\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}+\frac{d^3y}{dx^3}\frac{h^3}{2.3}+\&c.\angle 0,$$

$$-\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}-\frac{d^3y}{dx^3}\frac{h^3}{2.3}+\&c.\angle 0;$$

and similarly in the case of a *minimum*,

(B)

$$+\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}+\frac{d^3y}{dx^3}\frac{h^3}{2.3}+\&c.>0,$$

$$-\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}-\frac{d^3y}{dx^3}\frac{h^3}{2.3}+\&c.>0.$$

Now, as we are at liberty to take h as small as we please, we may suppose it so small, that in each series the amount of all the terms after the first shall be incomparably less than that term;* then the amount of all the terms in each series will have the same sign as ts first term, provided that $\frac{dy}{dx}$, the coefficient of h in that term, is not $=0$, for then the term itself would be $=0$: now this must really be the case, that is, $\frac{dy}{dx}$ must be $=0$; for were it otherwise, h might be taken so small, that one of each pair of series (A), (B) would be a positive, and the other a negative quantity, and the same would also be true for every smaller value of h. But this would not accord with the nature of a *maximum* or *minimum*, which requires, that, in the first case, the two series should be both less than 0; and that, in the second, they should be greater than 0: therefore, when the function y is a *maximum* or *minimum*, we must have $\frac{dy}{dx}=0$; and then it will follow, that in the former case,

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* For, supposing the series to be $ph+qh^2+rh^3+\&c.$ let it be put under this form $h(p+qh+rh^2+\&c.)$ As h decreases p remains the same; but the expression $qh+rh^2+\&c.$ decreases, and may be less than any thing assignable; therefore, ph may exceed $h(qh+rh^2+\&c.)$ in any ratio of inequality whatever.

$$\frac{d^2y}{dx^2}\frac{h^2}{2}+\frac{d^3y}{dx^3}\frac{h^3}{6}+\frac{d^4y}{dx^4}\frac{h^4}{24}+\&c. < 0,$$

$$\frac{d^2y}{dx^2}\frac{h^2}{2}-\frac{d^3y}{dx^3}\frac{h}{6}+\frac{d^4y}{dx^4}\frac{h^4}{24}-\&c. < 0;$$

and in the latter,

$$\frac{d^2y}{dx^2}\frac{h^2}{2}+\frac{d^3y}{dx^3}\frac{h^3}{6}+\frac{d^4y}{dx^4}\frac{h^4}{24}+\&c. > 0,$$

$$\frac{d^2y}{dx^2}\frac{h^2}{2}-\frac{d^3y}{dx^3}\frac{h^3}{6}+\frac{d^4y}{dx^4}\frac{h^4}{24}-\&c. > 0.$$

In all these series, the sign of the first term is the same; therefore, when h is a very small quantity, so that the amount of all the terms after the first is incomparably less than that term, the amount of all the terms in each pair will have the same sign as they ought, and this will also be true for every smaller value of h. Moreover, as in the case of a *maximum*, each series must be < 0, therefore $\frac{d^2y}{dx^2}$, the coefficient of the first term, must be a negative quantity. In the case of a *minimum*, however, each series is > 0, and therefore $\frac{d^2y}{dx^2}$ must be positive.

If, however, the substitution of a for x in the developements makes not only $\frac{dy}{dx}=0$, but also $\frac{d^2y}{dx^2}=0$; then, to satisfy the condition of the *maximum*, we must have

$$+\frac{d^3y}{dx^3}\frac{h^3}{6}+\frac{d^4y}{dx^4}\frac{h^4}{24}+\&c. < 0,$$

$$-\frac{d^3y}{dx^3}\frac{h^3}{6}+\frac{d^4y}{dx^4}\frac{h^4}{24}-\&c. < 0;$$

and in the case of the *minimum*,

$$+\frac{d^3y}{dx^3}\frac{h^3}{6}+\frac{d^4y}{dx^4}\frac{h^4}{24}+\&c. > 0,$$

$$-\frac{d^3y}{dx^3}\frac{h^3}{6}+\frac{d^4y}{dx^4}\frac{h^4}{24}-\&c. > 0.$$

By pursuing the same train of reasoning as before, it will appear, that these conditions can only be satisfied when we have also $\frac{d^3y}{dx^3}=0$; and so on.

63. Upon the whole, it appears that when y, any function of a single variable quantity x, is a *maximum* or *minimum*, then $\frac{dy}{dx}=0$; and that if the value of x, determined from this equation, make $\frac{d^2y}{dx^2}$ a negative quantity, the function y is a *maximum*; but if it be a positive quantity, then y is a *minimum*. If, however, this value of x render $\frac{d^2y}{dx^2}=0$; then, unless at the same time it make $\frac{d^3y}{dx^3}=0$, the function can neither be a *maximum* nor a *minimum*. If we have $\frac{d^3y}{dx^3}=0$, the function y will be a *maximum* when $\frac{d^4y}{dx^4}$ is negative, and a *minimum* when this expression is positive; and so on, the first fluxional coefficient which does not vanish, being always of an even order when y can have a *maximum* or *minimum* value.

Direct Method.

The correct theory of *maxima* and *minima*, was first given by Maclaurin in his Fluxions, Book I. chap. 9.

EXAMPLE 1. To divide a right line into two such parts, that the rectangle contained by its segments shall be the greatest possible.

Let the whole line be a, and one of its segments x; then the other will be $a-x$; and the rectangle, $x(a-x) = ax-x^2$. Therefore, we must have $y=ax-x^2$, a maximum; hence, by the general rule,

$$\frac{dy}{dx}=a-2x=0.$$

This equation gives $x=\frac{1}{2}a$. Moreover, since we have $\frac{d^2y}{dx^2}=-2$, a negative quantity, we infer that the value $x=\frac{1}{2}a$ corresponds to a maximum; which is also easily proved upon other principles.

Ex. 2. To find the fraction that exceeds its cube by the greatest quantity possible.

Let x be the fraction, then we must give such a value to x, that $y=x-x^3$ shall be a maximum. In this case,

$$\frac{dy}{dx}=1-3x^2=0;$$

therefore, $x=\pm\sqrt{\frac{1}{3}}$. And since $\frac{d^2y}{dx^2}=-6x=\mp 6\sqrt{\frac{1}{3}}$, it follows from the rule, that the *maximum* value of the function corresponds to $x=+\sqrt{\frac{1}{3}}$; but it has also a *minimum* value corresponding to $x=-\sqrt{\frac{1}{3}}$.

Ex. 3. To determine the greatest rectangle that can be inscribed in a given triangle.

Let ABC (Fig. 2. Plate CCLV.) be the given triangle, and EFGH the greatest rectangle that can be inscribed in it. Draw the perpendicular AD meeting EF in G. Put BC$=a$; AD$=b$; EF$=x$; and the area of the rectangle EFGH$=y$. By similar triangles, BC : AD :: EF : AG; that is, $a:b::x:$ AG; hence, AG$=\frac{bx}{a}$; and DG$=b-\frac{bx}{a}=\frac{b(a-x)}{a}$, and DG $\times$ EF$=\frac{b}{a}(ax-x^2)=y$, therefore,

PLATE CCLV. Fig. 2.

$$\frac{dy}{dx}=\frac{b}{a}(a-2x)=0;$$

hence $a=2x$, and $x=\frac{1}{2}a$. The altitude of the rectangle is therefore half that of the triangle.

64. When the quantity which is to be a *maximum* or *minimum* is multiplied or divided by any constant quantity, that quantity may be rejected: Thus we may reject $\frac{b}{a}$, and make $y=ax-x^2$; which will lead to the same result. In general, when a variable function is the greatest or least possible, any constant multiple or

part of that function, also any constant power or root of it, will be the greatest or least possible. In some cases, it may be convenient to remark, that when a quantity increases or decreases, its logarithm increases or decreases.

65. Ex. 4. Of all right angled triangles having the same hypothenuse, find that which has the greatest area.

Fig. 3. Let ABC be the triangle (Fig. 3.); put the common hypothenuse AC$=a$; the variable base AB$=x$; the area $=y$. Then, because by the elements of geometry, BC$=\sqrt{(a^2-x^2)}$, we have $y=\frac{1}{2}x\sqrt{(a^2-x^2)}$, and hence the value of x may be found as in the former examples. Or, we may reject the factor $\frac{1}{2}$, and find x, so that the square of the expression $x\sqrt{(a^2-x^2)}$, may be a *maximum* (art. 64.), so that putting $y'=x^2(a^2-x^2)$, we have

$$\frac{dy'}{dx}=2a^2x-4x^3=0.$$

Hence $x^2=\frac{1}{2}a^2$, from which it appears that the sides about the right angle are equal. In this, as in the preceding example, the nature of the question excludes the supposition of a *minimum*.

Ex. 5. To determine the dimensions of a cylindric measure, open at the top, which shall contain a given quantity (of liquor, grain, &c.) under the least internal superfices possible.

Fig. 4. Let ABCD be the measure (Fig. 4.); put the diameter BC$=x$, the depth AB$=v$; the number that expresses the circumference of a circle, of which the diameter is unity, viz. $3.14159=\pi$: and let c be the content of the cylinder. Then, by geometry, πx is the circumference of the base, and $\pi x v$ is the concave surface of the cylinder. Also, the area of the base is $\frac{\pi x^2}{4}$, and the solid content is $\frac{\pi x^2 v}{4}$; which being made $=c$, we find $v=\frac{4c}{\pi x^2}$; this value of v being put in the expression for the concave surface, it becomes $\frac{4c}{x}$; therefore, the whole internal surface of the cylinder is $\frac{4c}{x}+\frac{\pi x^2}{4}$, which being denoted by y, we have

$$\frac{dy}{dx}=+\frac{4c}{x^2}-\frac{\pi x}{2}=0;$$

$$\frac{d^2y}{dx^2}=\frac{8c}{x^3}+\frac{\pi}{2}.$$

From the first of these equations, we get $\pi x^3=8c$, and $\frac{8c}{x^3}=\pi$, and hence $\frac{d^2y}{dx^2}=\frac{3\pi}{2}$, as this is a positive quantity, the expression we have found for x^3 corresponds to a *minimum* value (art. 63.) Now, since $\pi x^3=8c$, and $\pi x^2 v=4c$; we have $\pi x^3=2\pi x^2 v$, and hence $x=2v$; thus it appears that the diameter of the base must be exactly double the depth of the measure; also, that $x=2\sqrt[3]{\frac{c}{\pi}}$.

Ex. 6. The flame of a candle is directly over the centre of a circle, the radius of which is 12 inches: what ought to be its height above the plane of the circle, so as to illuminate the circumference the most possible?

Fig. 5. Let BC be the candle, (Fig. 5.) C the position of the flame, and A any point in the circumference. By the principles of optics, the intensity of the illumination of the plane at any point will be directly as the sine of the angle of the incident rays, and inversely as the square of the distance from the luminous point: therefore, the effect of the candle to illuminate the plane at A may be expressed by $\frac{\text{sin. CAB}}{\text{CA}^2}$. Put AB$=a$; and sin. CAB $=x$; then, CA $=\frac{\text{AB}}{\text{cos. CAB}}=\frac{a}{\sqrt{(1-x^2)}}$; therefore, $\frac{\text{sin. CAB}}{\text{CA}^2}=\frac{x(1-x^2)}{a^2}$; and so, rejecting the constant divisor a^2, we have $y=x(1-x^2)=x-x^3$: Now we have already found (in Ex. 2.), that this function is a *maximum*, when $x=\sqrt{\frac{1}{3}}$: This makes the angle CAB $=35°\ 16'$, nearly, and AB : BC :: 1 : .71 nearly; therefore, BC$=8.5$ inches.

Ex. 7. To find the position of the planet Venus in respect of the earth and the sun, when the area of the illuminated part of her disk is a *maximum*.

Fig. 6. In Fig. 6. let S be the Sun, E the Earth, and the circle $a\,b\,c$ Venus. Draw Va and Vb perpendicular to VS and VE. The illuminated surface of Venus is the hemisphere $c\,b\,a$; but of this, only the part $b\,a$ is turned towards the Earth, and it appears as a luminous crescent contained between half the circumference of the disk and a semiellipse; the breadth of the crescent is the versed sine of the arc $a\,b$; but the angles DVa, EVb being equal, the angle aVb is equal to the angle DVE; therefore, the breadth of the crescent is as the versed sine of the angle DVE. Now, by the nature of the figure, the area of the crescent will be to the area of the whole disk, as its breadth to the diameter, (as is easily inferred from CONIC SECTIONS, Part VII. Prop. 3.), and again, the apparent area of the disk is inversely as the square of the distance of the planet from the Earth: therefore, the apparent illuminated area, as seen from the Earth, will always be directly as the versed sine of the angle DVE, and inversely as the square of EV, and may be expressed by $\frac{c(1-\text{cos. EVD})}{\text{EV}^2}$, or by $\frac{c(1+\text{cos. EVS})}{\text{EV}^2}$, c being some constant quantity.

Put SV$=a$, SE$=b$, VE$=x$; then, by trigonometry, cos. SVE $=\frac{a^2+x^2-b^2}{2ax}$. Let y denote the apparent illuminated disk, then, from what has been shewn, we have

$$y=\frac{c(a^2+x^2+2ax-b^2)}{2ax^3},$$

therefore, taking the fluxions,

$$\frac{dy}{dx}=\frac{c(3b^2-3a^2-4ax-x^2)}{2ax^4}=0.$$

Hence we have

$$x^2+4ax=3(b^2-a^2),$$

a quadratic equation, which gives

$$x=\sqrt{(3b^2+a^2)}-2a.$$

If we make $b=1000$, then $a=724$; and hence $x=429$. In the triangle SVE, it will be found that the angle E$=40°$ nearly. It is when Venus has this position, that she is sometimes seen in the day time. See ASTRONOMY, p. 655.

Ex. 8. To find the position of a straight rod, or beam, when it rests in equilibrio upon a prop, and one end touching an upright wall.

It is a principle in mechanics, that when a body rests in equilibrio, its centre of gravity is either the highest or the lowest possible. By this principle, the theory of *maxima et minima* may be elegantly applied to the resolution of innumerable problems in statics. In the present example, let EF (Fig. 7.) be the wall, PR Fig.

the prop, AB the beam which touches the wall at B, and rests upon the prop at P. Let C be the centre of gravity of the beam. Through P draw the horizontal line DE, and draw CD perpendicular to DE. Put PE$=a$, CB$=b$, these are given quantities; also, put PD$=x$, DC$=y$: Then, by the principles of mechanics, y must be the greatest possible.

From similar figures, BC : DE :: PC : PD; that is, $b : a+x :: \sqrt{(x^2+y^2)} : x$; Hence,

$$(a+x)^2\,(x^2+y^2)=b^2\,x^2,$$

and taking the fluxions, and dividing by $2\,d\,x$,

$$(a+x)\,(x^2+y^2)+(a+x)^2\left(x+y\,\frac{dy}{dx}\right)=b^2x.$$

Because y is a maximum, $\frac{dy}{dx}=0$, therefore this last equation may be abbreviated to

$$(a+x)\,(x^2+y^2)+x(a+x)^2=b^2x.$$

When we have eliminated x^2+y^2, by this and the first equation, we get

$$(a+x)^3=a\,b^2.$$

Hence x is determined.

In this example, as well as in some others, for the sake of brevity, we have assumed the possibility of the quantity y having a maximum, as it is sufficiently indicated by the nature of the question. For, supposing P the point of support, to be between, C and the wall, if B, the end of the rod, be carried along a vertical line FE, the line DC$=y$ will manifestly increase to a certain point, and then decrease.

66. In explaining this theory, we have only considered functions of a single variable quantity. When the expression to be a *maximum* or *minimum* contains functions of two or more variable quantities, which are independent of one another, the general theory becomes more intricate, and its complete explanation would swell this article beyond the limits we can allow to it. We must therefore refer, on this point, to Euler's *Calculus Differentialis*, Part 2d, Chap. xi; to Lagrange's *Theorie des Fonctions Analytiques*, No. 160; and to Lacroix's *Traite du Calcul Differentiel*, Vol. I. No. 165.

Method of Tangents.

g. 8.

67. Let CPD be any curve referred to an axis AB, (Fig. 8.) and let PQ, P′Q′ be two consecutive ordinates, and AQ, AQ′ the corresponding abscissæ, A being the origin of the co-ordinates. Through P′, P draw the secant P′P S, meeting the axis in S, and draw PE parallel to the axis, meeting P′Q′ in E. Put the abscissa AQ$=x$, the ordinate PQ$=y$, and QQ′ (the increment of x)$=h$. As y is a function of x, when x becomes $x+h$, by Taylor's theorem (art. 53) y becomes $y+\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}+\frac{d^3y}{dx^3}\frac{h^3}{2.3}+$ &c. but P′Q′ is the value of y corresponding to $x+h$; therefore,

$$\text{P}'\text{Q}'=y+\frac{dy}{dx}h+\frac{d^2y}{dx^2}\frac{h^2}{2}+\frac{d^3y}{dx^3}\frac{h^3}{2.3}+\text{\&c. and}$$

$$\text{P}'\text{E}=\frac{dy}{dx}h+\frac{d^2y}{dx^2}h^2+\text{\&c. and}\frac{\text{P}'\text{E}}{h}=\frac{\text{P}'\text{E}}{\text{PE}}=\frac{dy}{dx}+\frac{d^2y}{dx^2}h$$

+&c. Now $\frac{\text{P}'\text{E}}{\text{PE}}$ is the trigonometrical expression for the tangent of the angle P′PE, or S; therefore,

$$\text{tan. S}=\frac{dy}{dx}+\frac{d^2y}{dx^2}\frac{h}{2}+\frac{d^3y}{dx^3}\frac{h^2}{2.3}+\text{\&c.}$$

Suppose now QQ′$=h$, the increment of x, to be continually diminished; when Q′ comes to Q, the two points of intersection P′, P coincide, and the secant P′P S becomes PT, a tangent to the curve at P; and as the angle S becomes then the angle T, and $h=0$, we have

$$\text{tan. angle T}=\frac{dy}{dx}. \qquad (1.)$$

The segment TQ of the axis comprehended between PT the tangent, and PQ, the ordinate at the point of contact, is called the *subtangent*. By trigonometry, tan. T$=\frac{\text{PQ}}{\text{TQ}}=\frac{y}{\text{TQ}}$, therefore,

$$\text{subtangent TQ}=\frac{dx}{dy}y \qquad (2.)$$

Hence, in the right angled triangle TPQ, we have

$$\text{tangent PT}=\frac{y}{dy}\sqrt{(d\,x^2+d\,y^2)} \qquad (3.)$$

Draw PN perpendicular to the tangent at P, the point of contact, meeting the axis in N; the line PN is called a *Normal* to the curve at P; and QN, the segment of the axis between the ordinate and normal, is called the *Subnormal*. By the elements of geometry, the angle QPN is equal to the angle T; now we have found tan. T$=\frac{dy}{dx}$; therefore, observing that PQ$=y$, we have by trigonometry, and geometry,

$$\text{Subnormal QN}=\frac{dy}{dx}y. \qquad (4.)$$

$$\text{Normal PN}=\frac{y}{dx}\sqrt{(d\,x^2+d\,y^2)} \qquad (5.)$$

68. We shall now apply these formulæ to some examples.

Ex. 1. Let the curve be a circle, (Fig. 9.) and let A, one extremity of the diameter, be the origin of the co-ordinates; put the radius OA$=a$; the equation of the curve is $y^2=2\,a\,x-x^2$. Hence, taking the fluxions, $y\,d\,y=a\,d\,x-x\,d\,x$, and, by formula (2) (Art. 67.) Fig. 9.

$$\frac{dx}{dy}y=\frac{y^2}{a-x}=\text{TQ the subtangent;}$$

therefore, OQ : QP :: QP : QT.

Ex. 2. Suppose the curve a parabola, (Fig. 10.) and that A, the vertex of the axis, is the origin of the co-ordinates. Let a be the parameter of the axis. The equation of the curve (Conic Sections, Sect. VIII.) is $y^2=a\,x$; hence, $2\,y\,d\,y=a\,d\,x$, and Fig. 10.

$$\frac{dx}{dy}y=\frac{2\,y^2}{a}=\frac{2\,a\,x}{a}=2\,x=\text{TQ, the subtangent:}$$

$$\frac{dy}{dx}y=\frac{a}{2}=\text{QN, the subnormal.}$$

Hence it appears that the subtangent is bisected at the vertex; and that the subnormal is half the parameter.

Ex. 3. Let the curve be an ellipse, (Fig. 11.) and let O, the centre, be the origin of the co-ordinates. Let a denote half the greater, and b half the lesser axis: The equation of the curve is $a^2y^2+b^2x^2=a^2b^2$; (Conic Sections, Sect. VIII.) hence $a^2y\,d\,y+b^2x\,d\,x=0$, and Fig. 11.

$$\frac{dx}{dy}y=-\frac{a^2y^2}{b^2x}=-\frac{a^2-x^2}{x}=\text{TQ.}$$

The general formula for the subtangent was investigated upon the supposition that the abscissa and subtangent were on the same side of the ordinate: as in the present case the subtangent comes out a negative quantity, we may infer that it and the abscissa are on opposite sides of the ordinate; So that, without regarding position, $TQ = \frac{a^2 - x^2}{x}$, from which it appears, that the subtangent is independent of the conjugate axis. In the hyperbola, the subtangent may be found by exactly the same process.

Fig. 12. Ex. 4. Let the curve be a cycloid, (Fig. 12.) of which AB is the axis, and AHB the generating circle. Let the origin of the co-ordinates be A, the vertex: and let us suppose that the radius of the generating circle is unity. Put the arc $AH = v$; then, by the nature of the curve, (see Epicycloid,) $x = 1 - \cos. v$, $y = v + \sin. v$; therefore $dx = \sin. v\, dv$, $dy = dv + \cos. v\, dv$, therefore,

$$\frac{dx}{dy}y = \frac{y \sin. v}{1 + \cos. v} = \frac{y(1 - \cos. v)}{\sin. v.} = TQ,$$

That is, $\frac{PQ \times AQ}{HQ} = TQ$; therefore, QH : QP :: QA : QT. Hence it appears that the tangent PT is parallel to AH, the chord of the generating circle, as was proved in the article Epicycloid.

Ex. 5. In the logarithmic curve, of which the equation is $y = a^x$, we have $dy = a^x\, \mathrm{l.}(a)\, dx = y\ \mathrm{l.}(a)\, dx$, therefore,

$$\frac{dx}{dy}y = \frac{1}{\mathrm{l.}(a)} = \text{subtangent}.$$

In this case, the subtangent is a constant quantity.

69. When a curve is expressed by a polar equation, we may first find the equation of the rectangular co-ordinates, as is explained in Curve Lines, art. 21. and then apply the formulæ; but it will be more convenient to have formulæ suited to that particular mode of expressing the nature of the curve. Let the centre of the polar co-ordinates be at A, the origin of the rectangular co-ordinates, (Fig. 13.) and suppose the curve to be defined by an equation between the revolving radius $AP = r$, and the variable angle $PAB = v$, which it makes with the axis AB. We may now regard the angle v as the independent variable qnantity, and $AQ = x$, $QP = y$, and $AP = r$ as functions of that quantity. Put t for the angle PTQ; then because the angle $TPA = v - t$, therefore $\tan. TPA = \frac{\tan. v - \tan. t}{1 + \tan. v \tan. t}$, (Arithmetic of Sines, art. 26.) But $\tan. v = \frac{PQ}{AQ} = \frac{y}{x}$, and we have found (art. 67.) that $\tan. t = \frac{dy}{dx}$; therefore, Fig. 13.

$$\tan. TPA = \frac{\frac{y}{x} - \frac{dy}{dx}}{1 + \frac{ydy}{xdx}} = \frac{ydx - xdy}{xdx + ydy}:$$

Now, by trigonometry,

$$x = r \cos. v,\quad y = r \sin. v;$$

therefore, taking the fluxions, (art. 29. and art. 26. Rule D.)

$$dx = \cos. v\, dr - r \sin. v\, dv,$$
$$dy = \sin. v\, dr + r \cos. v\, dv;$$

and hence again,

$$y\, dx = r \cos. v \sin. v\, dr - r^2 \sin.^2 v\, dv,$$
$$x\, dy = r \cos. v \sin. v\, dr + r^2 \cos.^2 v\, dv,$$
$$x\, dx = r \cos.^2 v\, dr - r^2 \cos. v \sin. v\, dv,$$
$$y\, dy = r \sin.^2 v\, dr + r^2 \cos. v \sin. v\, dv.$$

Therefore, $y\,dx - x\,dy = -r^2\,dv$,

$$x\,dx + y\,dy = r\,dr;$$

and hence,

$$\tan. TPA = -\frac{r^2\,dv}{r\,dr} = -\frac{r\,dv}{dr}. \quad (6)$$

Through A, draw AT′ perpendicular to the polar radius AP meeting the tangent in T′; and from the point of contact P, draw PN perpendicular to the tangent, meeting T′A in N: We may now consider AT′ as the *subtangent* and AN as the *subnormal*. And because, in the similar right angled triangles T′AP, PAN,

$$\text{rad.} : \tan. T'PA\left(= -\frac{r\,dv}{dr}\right) :: PA(=r) : AT' :: NA : PA,$$

therefore. subtangent $AT' = -\frac{dv}{dr}r^2$, (7)

$$\text{subnormal } AN = -\frac{dr}{dv}. \quad (8)$$

Ex. Let the curve be the spiral of Archimedes, the nature of which is defined by the equation $2\pi r = av$, where π denotes two right angles, and a is a given line, viz. the value of r when $v = 2\pi$. In this case, $2\pi\,dr = a\,dv$, and

$$-\frac{dv}{dr}r^2 = -\frac{2\pi r^2}{a} = \text{subtangent}.$$

70. In some curves, the distance between the origin of the co-ordinates and the point in which the tangent meets the axis increases continually, so that when the abscissa x is infinite, that distance becomes infinite. In others, even when x is infinite, the tangent cuts the axis at a finite distance from the origin: It is then an *asymptote* to the curve. If, from the subtangent $QT = \frac{dx}{dy}y$, (Fig. 8.) the abscissa $AQ = x$ be subtracted, Fig. 8. the remainder $\frac{dx}{dy}y - x$ is the general expression for TA, the distance of the intersection of the tangent and axis from the origin of the co-ordinates. If when x is infinite this expression is finite, we may conclude that the curve has asymptotes, but if it be infinite, then the curve has no asymptote.

Ex. 1. The equation of the hyperbola (Conic Sections, Sect. VIII.) is $a^2y^2 = b^2x^2 - a^2b^2$, the origin of the co-ordinates being at the centre; in this case, $a^2y\,dy = b^2x\,dx$, and

$$\frac{dx}{dy}y = \frac{a^2y^2}{b^2x} = \frac{x^2 - a^2}{x} = x - \frac{a^2}{x};$$

and $\frac{dx}{dy}y - x = -\frac{a^2}{x}$.

When x is supposed infinite, the expression $-\frac{a^2}{x}$ becomes $=0$; hence we infer that the curve has asymptotes, which pass through the centre.

Ex. 2. The equation of the parabola is $y^2 = ax$, hence $\frac{dx}{dy}y - x = x$; when x is infinite, this quantity becomes infinite; therefore the curve has no asymptote.

The method of tangents is an important branch of the theory of curve lines. It serves to determine their greatest and least ordinates, (which may also be found by the theory of *maxima* and *minima*), and many circumstances relating to their figure; but our limits will not allow us to touch on these. The reader will find them amply detailed in *Theorie des Fonctions Analytiques*, Lagrange; *Traite du Calcul Differentiel*, vol. i. Lacroix; *A Treatise of Fluxions*, Maclaurin; *Analyse* *des Infiniment petits*, L'Hopital; and in most works which treat expressly of the fluxional or differential calculus.

Of the Fluxions of the Area and the Arc of a Curve.

71. In any curve, we may consider x, one of the co-ordinates, as an independent variable quantity, and then the other, also the area, the arc, and every quantity connected with the curve, may be regarded as functions of that quantity.

Fig. 14. Let CPD be a curve referred to an axis AB (Fig. 14.), and let AQ$=x$ and QP$=y$ be rectangular co-ordinates, of which A is the origin, and let CEQP be the curvilineal space comprehended between two ordinates CE, PQ, one of which CE may be supposed to have a given position. Draw another ordinate P′Q′, such, that any number of ordinates between PQ and P′Q′ shall form a series continually increasing or continually decreasing, which is evidently always possible. Complete the rectangles QF, GQ′; and assuming QQ′ as the increment of x, let it be denoted as usual by h. Putting s to denote the area CEQP, and regarding it as a function of x, let $s=f(x)$; then the area CEQ′P′ will be $f(x+h)$; and their difference PQQ′P′$=f(x+h)-f(x)$ will be the increment of s, corresponding to h the increment of x. Let P′F, the increment of y, be denoted by k.

The curvilineal space PQQ′P′ is less than the rectangle GQ′$=(y+k)h$, but greater than the rectangle PQ′$=yh$; therefore, it will be equal to $(y+k')h$, k' being a quantity between 0 and k. Hence, $f(x+h)-f(x)=(y+k')h$, and

$$\frac{f(x+h)-f(x)}{h}=y+k'.$$

Suppose now h to decrease continually, then k and k' will decrease continually, and the *limit* of the ratio $\frac{f(x+h)-f(x)}{h}$ will be y; therefore, the fluxional ratio

$$\frac{d\left\{f(x)\right\}}{dx}, \text{ or } \frac{ds}{dx}=y, \text{ art. 23. and hence}$$

$$ds=y\,dx \qquad (1)$$

From which it appears, that *the fluxion of a curvilineal area is equal to the ordinate multiplied by the fluxion of the abscissa.*

15. 72. When the nature of the curve is expressed by a polar equation in Fig. 15, let AC be a line given by position, which meets the curve in C, and A a given point in that line, round which the variable radius AP revolves. Draw another radius AP′, so that all intermediate radii may form with them an increasing or a decreasing series of quantities, and on A as a centre describe the circular arcs PG, P′F. Put PA$=r$, the angle PAC$=v$, and the curvilineal space ACP$=s$; and let r and s be considered as functions of the angle v. Put h for the angle PAP′, the increment of v. Then employing the usual notation $s=$CPA$=f(v)$, and area CP′A$=f(v+h)$, therefore area PAP′$=f(v+h)-f(v)$. Put $k=$P′G, the increment of r, then the arc PG$=rh$, the arc P′F$=(r-k)h$, the sector APG$=\frac{1}{2}r^2h$, the sector AP′F$=\frac{1}{2}(r-k)^2h$. Now the curvilineal space PAP′, is less than the sector APG, but greater than the sector AP′F; therefore it will be equal to $\frac{1}{2}(r-k')^2h$, supposing k' some quantity greater than 0, and less than k; hence $f(v+h)-f(v)=\frac{1}{2}(r-k')^2h$, and

$$\frac{f(v+h)-f(v)}{h}=\tfrac{1}{2}(r-k')^2:$$

as h decreases, k and k' decrease, so that the limit of the expression for the ratio is $\frac{1}{2}r^2$; therefore

$$\frac{d\left\{f(v)\right\}}{dv} \text{ or } \frac{ds}{dv}=\tfrac{1}{2}r^2, \text{(Art. 23,) and}$$

$$ds=\tfrac{1}{2}r^2\,dv \qquad (2.)$$

Hence it appears, *that the fluxion of the curvilineal sector* CAP$=s$, *is half the product of the square of the revolving radius* r, *and the fluxion of the angle it makes with the fixed axis* AC.

73. Archimedes, and all geometers since his time, have admitted as an axiom, that if two lines of any kind have the same extremities, and their concavities turned both the same way, the shorter of the two is that which is in the space bounded by the other line, and the straight line which joins their common extremities. Hence it follows, that an arc of a curve, which has its concavity turned all one way, is greater than its chord, but less than the sum of two tangents drawn at the extremities of the arc. Proceeding from this principle, we may determine the *limits* of the ratios of the arc, the chord, and the sum of the two tangents to one another, supposing the arc to be diminished indefinitely, as follows:

In Fig. 16. let ADB be any arc of a curve, AB$=c$ the chord; AC$=b$, and BC$=a$, the tangents at its extremities. By trigonometry, $\frac{a}{c}=\frac{\sin. A}{\sin. (A+B)}$, and $\frac{b}{c}=\frac{\sin. B}{\sin. (A+B)}$, therefore $\frac{a+b}{c}=\frac{\sin. A+\sin. B}{\sin. (A+B)}$. But $\sin. A+\sin. B=2\sin. \frac{1}{2}(A+B)\cos. \frac{1}{2}(A-B)$, (ARITHMETIC *of Sines*, art. 12,) and $\sin. (A+B)=2\sin. \frac{1}{2}(A+B)\times\cos. \frac{1}{2}(A+B)$, (art. 13, form. G), therefore Fig. 16.

$$\frac{a+b}{c}=\frac{\cos. \frac{1}{2}(A-B)}{\cos. \frac{1}{2}(A+B)}.$$

Conceive now the arc ADB to decrease continually, by the point B approaching to A; the angles A and B will manifestly both decrease, and they may become less than any assignable angles whatever; therefore A$-$B, and A$+$B, both approach continually to 0; and $\cos. \frac{1}{2}(A-B)$, and $\cos. \frac{1}{2}(A+B)$, approach to 1, which is their common limit. Hence the limit of the ratio of $a+b$ to c is the ratio of 1 to 1, that is, a ratio of equality; and as the arc ADB is always of an intermediate magnitude between $a+b$ and c, much more is the limit of the ratio of the arc to the chord, also the limit of its ratio to the sum of the tangents a ratio of equality.

74. In the curve CPD, (Fig. 17.) let PQ, P′Q′ be two ordinates perpendicular to the axis AB; and suppose that the intermediate ordinates go on continually increasing, or else decreasing. Draw the tangents PH, P′H′, meeting the ordinates in H and H′. The arc PP′ is less than one of the two tangents PH, P′H′, but greater than the other; for draw the chord PP′, and let the tangents PH, P′H′ meet in I, then because, from the nature of the figure, P′H′, one of the tangents, must make a greater acute angle with the ordinates than the chord makes with them, it will be less than the chord, and therefore it will be less than the arc. And again, because the acute angle, which the other tangent PH makes with the ordinates, is less than the acute angle made by P′H′, the line HI must be greater than P′I, and HP greater than P′I$+$IP, and therefore HP must be greater than the are P′P. Fig. 17.

Hence also it is easy to infer, that the limit of the ratio of an arc to its chord is a ratio of equality. For the lines PH, P′H′, are manifestly to one another as the cosecants of their inclinations to the ordinate PQ, (TRIGONOMETRY); but as the point P′ approaches to P, the inclination of the line P′H′ approaches to that of PH, and at last the two lines coincide; therefore, the limit of the ratio of PH to P′H′ is a ratio of equality, and as the chord and arc are of an intermediate magnitude between PH and P′H′, the limit of their ratio must also be that of equality.

Fig. 17. 75. Supposing A to be the origin of the rectangular co-ordinates, (Fig. 17.) and C a given point in the curve, let AQ=x, PQ=y, CP=z, and let z be considered as a function of x. Draw PK parallel to the axis; then, because the arc PP′, and the line PK, are corresponding increments of z and x, the expression for the fluxional ratio $\frac{dz}{dx}$ will be equal to the limit to which the fraction $\frac{\text{arc PP}'}{\text{PK}}$ approaches, when QQ′=PK, the increment of x, is diminished indefinitely, (art. 23.) Now we have seen, that the arc PP′ is of an intermediate magnitude between the lines PH, P′H′, which touch the curve at P and P′; therefore the fraction $\frac{\text{arc PP}'}{\text{PK}}$ is always of an intermediate magnitude between these two, $\frac{\text{PH}}{\text{PK}}$, and $\frac{\text{P}'\text{H}'}{\text{PK}}$. But we have seen, (art. 74.) that when P′ approaches to P, the ratio of P′H′ to PH approaches to a ratio of equality; therefore the limit of $\frac{\text{P}'\text{H}'}{\text{PK}}$ will be $\frac{\text{PH}}{\text{PK}}$, and consequently the limit of $\frac{\text{arc PP}'}{\text{PK}}$ will also be $\frac{\text{PH}}{\text{PK}}$. Hence we have $\frac{dz}{dx}=\frac{\text{PH}}{\text{PK}}$. And since, by trigonometry, $\frac{\text{PH}}{\text{PK}}$ = secant of the angle HPK=$\sqrt{(1+\tan.^2 \text{HPK})}$, and by art. 67, formula (1), tan. HPK $=\frac{dy}{dx}$; therefore $\frac{dz}{dx}=\sqrt{\left(1+\frac{dy^2}{dx^2}\right)}$, and hence again,

$$dz=\sqrt{(dx^2+dy^2)} \qquad (1.)$$

From which expression it appears, that *the square of the fluxion of the arc, is the sum of the squares of the fluxions of the rectangular co-ordinates.*

Fig. 15. 76. In the case of curves expressed by a polar equation, (Fig. 15,) let A be the given point, about which the radius AP=r revolves; put v for the variable angle which r makes with AB, a line given by position passing through A; and suppose the curve to be also referred to this line as an axis by rectangular co-ordinates, having their origin at A, so that AQ=x and QP=y, then

$$x=r\cos. v, \qquad y=r\sin. v,$$

$$dx=-r\sin. v\,dv+\cos. v\,dr,$$

$$=-y\,dv+\frac{x}{r}dr,$$

$$dy=r\cos. v\,dv+\sin. v\,dr,$$

$$=x\,dv+\frac{y}{r}dr,$$

$$dx^2=y^2dv^2+\frac{x^2}{r^2}dr^2-\frac{2xy}{r}dv\,dr,$$

$$dy^2=x^2dv^2+\frac{y^2}{r^2}dr^2+\frac{2xy}{r}dv\,dr;$$

Therefore,

$$dx^2+dy^2=(x^2+y^2)\left(dv^2+\frac{dr^2}{r^2}\right),$$

but $x^2+y^2=r^2$, and $dx^2+dy^2=dz^2$, (art. 75.) Therefore,

$$dz=\sqrt{(r^2dv^2+dr^2)} \qquad (2.)$$

This formula expresses the fluxion of the arc of a curve, by the fluxion of the revolving radius r, and the fluxion of the angle which it makes with the axis AB.

77. We shall now explain another method of defining a curve by a polar equation, which leads to a simple expression for the fluxion of the arc.

Fig. 18. Let CPD (Fig. 18.) be the curve, and A a given point in AB, a straight line given by position. Draw a tangent PE at any point P, and AE a perpendicular on the tangent from A; then, if we know the relation between the angle BAE and the perpendicular AE, we can find the value of the perpendicular, corresponding to any given value of the angle; and, as the fluxional calculus gives a general expression for the tangent PE, in terms of the perpendicular and the angle, (as we shall presently shew), we can find also the length of the tangent: hence the point P may be found, and as many more points in the curve as we please.

Take another point P′ in the curve, and draw a tangent P′E′, meeting the former in G; also draw AE′ perpendicular to P′E′. Let the angle BAE be denoted by u, the arc CP by z, the perpendicular AE by p, and EP, the part of the tangent between the perpendicular and point of contact, by t; then, supposing the angle u to be the independent variable quantity, p, t, and z, may be regarded as functions of u. Put h for the angle EAH, the increment of u, and p' for AE′; also t' for P′E′, the new values of p and t, corresponding to $u+h$, the new value of u. From the disposition of the lines in the figure, we have

$$\begin{aligned}\text{E}'\text{P}'-\text{EP}&=\text{E}'\text{G}+\text{GP}'-(\text{EH}+\text{HG}-\text{GP})\\&=\text{PG}+\text{GP}'-\text{EH}-(\text{HG}-\text{GE}');\end{aligned}$$

and dividing by the arc h,

$$\frac{\text{E}'\text{P}'-\text{EP}}{h}=\frac{\text{PG}+\text{GP}'}{h}-\frac{\text{EH}}{h}-\frac{\text{HG}-\text{GE}'}{h}.$$

Now, by trigonometry, EH=p tan. h; and, because the triangles AEH, GE′H are similar, E′G = GH × cos. h; therefore, by substituting, we get

$$\frac{t'-t}{h}=\frac{\text{PG}+\text{GP}'}{h}-p\frac{\tan. h}{h}-\frac{1-\cos. h}{h}\text{HG}.$$

Suppose now, h to be diminished indefinitely, by which P′ will approach to P; we have then, *limit* of $\frac{t'-t}{h}=\frac{dt}{du}$ (art. 23), and *limit* of $\frac{\text{PG}+\text{GP}'}{h}=\frac{dz}{du}$ (art. 23. and 73.); and because *limit* $\frac{\tan. h}{h}=1$ (art. 73.); therefore, *limit* $p\frac{\tan. h}{h}=p$. And since $\cos. h=1-\frac{h^2}{2}+\frac{h^4}{24}-$&c. (art. 53.); therefore $\frac{1-\cos. h}{h}=\frac{h}{2}-\frac{h^3}{24}+$ &c. and *limit* $\frac{1-\cos. h}{h}$ HG=0.

Hence, upon the whole,

$$\frac{dt}{du}=\frac{dz}{du}-p.$$

and $dz-dt$ or $d(z-t)=p\,du$.

In the figure from which this formula has been investigated, the arc and tangent proceed in the same direction from the point of contact: If they had proceeded in contrary directions, the formula would have been

$$d(z+t)=p\,du$$

To express t by means of p and u, we have

$$AE' - AE = AH + HE' - AE$$
$$= HE' + AH - AE;$$

Now, $HE' = E'G \times \tan. h$, and $AE = AH \times \cos. h$; therefore, after substituting and dividing by h,

$$\frac{p'-p}{h} = \frac{\tan. h}{h} E'G + \frac{1-\cos. h}{h} AH.$$

Suppose now h to decrease continually, then we have *limit* $\frac{p'-p}{h} = \frac{dp}{du}$; *limit* $\frac{\tan. h}{h} = 1$, *limit* $E'G = t$; *limit* $\frac{1-\cos. h}{h} = 0$; therefore

$$\frac{dp}{du} = t.$$

This formula corresponds to the case in which the tangent and curve proceed in the same direction from the point of contact; when they proceed in opposite directions, it will be $\frac{-dp}{du} = t$, so that, including both cases in one formula, we have

$$t = \pm \frac{dp}{du}. \qquad \text{(A)}$$

This formula gives the tangent in terms of p and u, when the relation of p to u is known. Hence, also, it follows, that $dt = \pm \frac{d^2 p}{du}$: so that, in addition to the formulæ investigated in art. 75. and art. 76. for the fluxion of an arc; from what has been found in this article, we have these two,

$$d(z \mp t) = p\,du. \qquad (3)$$
$$dz = p\,du + \frac{d^2 p}{du}. \qquad (4)$$

We do not recollect to have seen these in any work on fluxions: they deserve attention on account of some elegant applications of which they are susceptible.

The application of the formulæ investigated in this Section, will be found in the Second Part of this article, when we come to the Quadrature and Rectification of Curves.

Of the Fluxions of Solids and Surfaces of Revolution.

78. *A solid of revolution* is that which is generated by the rotation of a curve of any kind about its axis, just as a sphere is generated by the rotation of a semicircle about its diameter, or a right cone, by the rotation of a right angled triangle about one of the sides containing the right angle. The curve surface of a solid, generated in this manner, is a *surface of revolution*. Figures of this kind are also called *Conoids*. They all agree in this property, that any section of the solid by a plane perpendicular to the axis of revolution, is a circle.

19. 79. Let PAp be a solid of revolution, (Fig. 19.), AB its axis, PEp and $P'E'p'$, two sections perpendicular to the axis, such, that these, and any intermediate sections, shall form a series that goes on increasing or decreasing: Let Pp and $P'p'$ be the diameters of the sections, and QQ' the segment of the axis between them. Construct the cylinders PEp-HGh, and $P'E'p'$-KFk, having the common altitude $Q'Q$. Put $AQ = x$, $PQ = y$, the solid $APEp = s$, the number 3.14159 (the ratio of the circumference to the diameter of a circle) $= \pi$; also put h for QQ', the increment of x; k for $P'H$, the increment of y; and i for the conoidal solid $P'E'p'$-PEp, the increment of s. Then, by the elements of geometry,

Circle $PEp = \pi y^2$; circle $P'E'p' = \pi(y+k)^2$;
Cylinder PEp-$HGh = \pi y^2 h$,
Cylinder KFk-$P'E'p' = \pi(y+k)^2 h$.

As the conoidal solid $P'E'p'$-$PEp = i$ is greater than one of these cylinders, and less than the other, we have $i = \pi(y+k')^2 h$, an expression in which k' is some quantity less than k, and greater than 0; and therefore,

$$\frac{i}{h} = \pi(y+k')^2.$$

Substituting now the fluxional ratio $\frac{ds}{dx}$ for the limit of the ratio $\frac{i}{h}$, and observing that the limit of $(y-k')^2$ relatively to the decrease of h is y^2, we find

$$\frac{ds}{dx} = \pi y^2,$$

$$\text{and } ds = \pi y^2 dx.$$

Hence it appears, *that the fluxion of a solid of revolution is equal to the product of the general expression for the section of the solid, by a plane perpendicular to the axis, and the fluxion of the axis.*

80. To find the fluxion of the surface generated by the rotation of the curve APP' (Fig. 20.), join the extremities of the ordinates PQ, $P'Q'$ by the chord PP', and draw the tangents PE, $P'E$, meeting in E, and draw EF perpendicular to the axis AB, meeting it in F. By the revolution of the curve, the chord PP', and the tangents PE, $P'E$, generate surfaces of truncated cones: and, by an axiom in the geometry of solids, the surface generated by the arc PP', which may be regarded as the increment of the surface, generated by the curve AP, is greater than the conical surface generated by the chord PP', but less than the two surfaces generated by the tangents PE, $P'E$. Now, by mensuration, the surface generated by the chord PP' is Fig. 20.

$$\pi(PQ + P'Q')PP'; \qquad (1)$$

and the two surfaces generated by the tangents PE, $P'E$ are, taken together,

$$\pi\left\{(PQ + EF)PE + (P'Q' + EF)P'E\right\} \qquad (2)$$

Therefore, between these two quantities, the surface generated by the arc PP' is always contained. But as P' approaches to P, the lines PQ, EF, $P'Q'$ approach to equality; so that, ultimately, $PQ + P'Q'$, $PQ + EF$, $P'Q' + EF$ are to be considered as equal; therefore, the limit of the ratio of the expressions (1), (2) is evidently the same as the limit of the ratio of the chord PP' to $PE + P'E$, the sum of the tangents; and as this last is a ratio of equality, (73.) it follows that the limit of the ratio of the curve surface generated by the arc PP', to the conical surface generated by the chord PP', is a ratio of equality.

Put $x = AQ$; $y = PQ$, $z =$ arc AP, $h = QQ'$, the increment of x; $k = P'H$, the increment of y; and $l = PP'$ the increment of z. Also put v for the curve surface generated by the arc CP, and i for its increment; then we have

$$\text{surf. gen. by chord } PP' = \pi(2y+k) \times \text{chord } PP',$$

and,

$$\frac{\text{surf. gen. by chord } PP'}{h} = \pi(2y+k)\frac{\text{chord } PP'}{h}.$$

Hence, passing to the limits, and substituting the surface generated by the arc, for that generated by the chord and the arc for the chord, also observing that the limit of $2y+k$ is $2y$, we get

$$limit\ \frac{i}{h} = 2\pi y \times limit\ \frac{l}{h};$$

and again, substituting the fluxional ratios instead of the limiting ratios of the increments, and regarding v and z as functions of x,

$$\frac{dv}{dx} = 2\pi y \frac{dz}{dx},$$

Hence, $dv = 2\pi y\, dz$.

Thus it appears, *that the fluxion of a surface of revolution is equal to the fluxion of the arc of the generating curve, multiplied by the general expression for a section of the surface, by a plane perpendicular to its axis.*

On the Contact of Curves, and Circle of Curvature.

Fig. 21.

81. Let two curves, CD, cd have the same axis AB, (Fig. 21.) and the same point A for the origin of their co-ordinates; let $y = P'Q'$, and $v = P''Q'$ be their respective ordinates, corresponding to the common abscissa $x = AQ'$, and let their equations be $y = f(x)$, and $v = F(x)$. Let us also suppose, that when x becomes $x + h$, y becomes y', and v becomes v': then, by Taylor's theorem, (art. 52.)

$$y' = y + \frac{dy}{dx} h + \frac{d^2 y}{dx^2} \frac{h^2}{2} + \&c.$$

$$v' = v + \frac{dv}{dx} h + \frac{d^2 v}{dx^2} \frac{h^2}{2} + \&c.$$

Suppose now the curves to have a common point P, at which $y = v$; then if $\frac{dy}{dx} = \frac{dv}{dx}$; the nature of their contact at that point is such, that no third curve having the same common point, can pass between them, unless it has a like property; that is, supposing u to be the ordinate of the third curve, corresponding to the common abscissa x, and u' its value, corresponding to $x + h$, so that

$$u' = u + \frac{du}{dx} h + \frac{d^2 u}{dx^2} \frac{h^2}{2} + \&c.$$

this curve, leaving P, cannot pass between the other two, unless $\frac{du}{dx} = \frac{dy}{dx} = \frac{dv}{dx}$. For let us suppose it possible; then because in general, $P'P'' = y' - v' = y - v + \left(\frac{dy}{dx} - \frac{dv}{dx}\right) h + \left(\frac{d^2 y}{dx^2} - \frac{d^2 v}{dx^2}\right) \frac{h^2}{2} + \&c.$

and by hypothesis, $y = v$, also $\frac{dy}{dx} = \frac{dv}{dx}$, therefore,

$$y' - v' = \left(\frac{d^2 y}{dx^2} - \frac{d^2 v}{dx^2}\right) \frac{h^2}{2} + \left(\frac{d^3 y}{dx^3} - \frac{d^3 v}{dx^3}\right) \frac{h^3}{6} + \&c.$$

This is the general expression for the excess of P′Q′, the ordinate of the first curve above P″Q′, the ordinate of the second. In like manner, the difference of the ordinates of the first and third curve, or

$$y' - u' = y - u + \left(\frac{dy}{dx} - \frac{du}{dx}\right) h + \&c.$$

or, because $y = u$,

$$y' - u' = \left(\frac{dy}{dx} - \frac{du}{dx}\right) h + \left(\frac{d^2 y}{dx^2} - \frac{d^2 u}{dx^2}\right) \frac{h^2}{2} + \&c.$$

Now, because this third curve is supposed to pass between the other two, (that is, between P′ and P″,) we must have, to a certain extent on each side of P, $y' - v' > y' - u'$, that is,

$$\left(\frac{d^2 y}{dx^2} - \frac{d^2 v}{dx^2}\right) \frac{h^2}{2} + \left(\frac{d^3 y}{dx^3} - \frac{d^3 v}{dx^3}\right) \frac{h^3}{6} + \&c.$$
$$> \left(\frac{dy}{dx} - \frac{du}{dx}\right) h + \left(\frac{d^2 y}{dx^2} - \frac{d^2 u}{dx^2}\right) \frac{h^2}{2} + \&c.$$

and hence, dividing by h,

$$\left(\frac{d^2 y}{dx^2} - \frac{d^2 v}{dx^2}\right) \frac{h}{2} + \left(\frac{d^3 y}{dx^3} - \frac{d^3 v}{dx^3}\right) \frac{h^2}{6} + \&c.$$
$$> \left(\frac{dy}{dx} - \frac{du}{dx}\right) + \left(\frac{d^2 y}{dx^2} - \frac{d^2 u}{dx^2}\right) \frac{h}{2} + \&c.$$

This ought to be true for every value of h that is less than QQ′. But h being supposed to decrease, the first of these two expressions may become less than any thing assignable, because h enters into all its terms, while the second approaches to the limit $\frac{dy}{dx} - \frac{du}{dx}$. Now this conclusion is incompatible with the first expression, being greater than the second, unless $\frac{dy}{dx} - \frac{du}{dx} = 0$, that is, $\frac{dy}{dx} = \frac{du}{dx}$, for then it is only necessary that

$$\left(\frac{d^2 y}{dx^2} - \frac{d^2 v}{dx^2}\right) h + \&c. > \left(\frac{d^2 y}{dx^2} - \frac{d^2 u}{dx^2}\right) h + \&c.$$

which is evidently possible. Hence between the courses of the two curves, which have a common ordinate $y = v$, and which have also $\frac{dy}{dx} = \frac{dv}{dx}$, no other curve can pass; unless the fluxion of its ordinate u be equal to the fluxion of y or of v; so that $\frac{du}{dx} = \frac{dy}{dx}$.

82. Again; if in the two curves, whose equations are $y = f(x)$, $v = F(x)$, and which have a common ordinate $y = v$, we have also $\frac{dy}{dx} = \frac{dv}{dx}$, and $\frac{d^2 y}{dx^2} = \frac{d^2 v}{dx^2}$; then, no third curve, of which the equation is $u = \phi(x)$, and which has a common ordinate with the other two, can pass between them, unless at the same time $\frac{dy}{dx} = \frac{du}{dx}$, and $\frac{d^2 y}{dx^2} = \frac{d^2 u}{dx^2}$. For if it were possible, we would, as in last article, have $y' - v' > y' - u'$, or, (rejecting the quantities that cancel each other)

$$\left(\frac{d^3 y}{dx^3} - \frac{d^3 v}{dx^3}\right) \frac{h^3}{6} + \left(\frac{d^4 y}{dx^4} - \frac{d^4 v}{dx^4}\right) \frac{h^4}{24} + \&c.$$
$$> \left(\frac{dy}{dx} - \frac{du}{dx}\right) h + \left(\frac{d^2 y}{dx^2} - \frac{d^2 u}{dx^2}\right) \frac{h^2}{2} + \&c.$$

Now this cannot hold true, unless $\frac{dy}{dx} - \frac{du}{dx} = 0$, and also $\frac{d^2 y}{dx^2} - \frac{d^2 u}{dx^2} = 0$; for, were this not the case, h might be taken of such a magnitude, that the whole amount of the first of these two expressions should be less than either the first or second term of the other expression, in any ratio of inequality whatever, instead of being greater than the whole expression; because of its terms involving higher powers of h. If, however, $\frac{dy}{dx} = \frac{du}{dx}$, and $\frac{d^2 y}{dx^2} = \frac{d^2 u}{dx^2}$, then, that the third curve may pass between the other two, it is only requisite that

$$\left(\frac{d^3 y}{dx^3} - \frac{d^3 v}{dx^3}\right) h^3 + \&c. > \left(\frac{d^3 y}{dx^3} - \frac{d^3 u}{dx^3}\right) h^3 + \&c.$$

which is certainly possible.

83. In general, if there be any curve whatever, and another given curve, have a common point with it, which requires that their ordinates corresponding to the same abscissa should be equal; then, if the first

fluxions of these ordinates for the same abscissa are also equal, it will be impossible that any other curve drawn through that point can pass between them, unless the first fluxion of its ordinate corresponding to the same abscissa is equal to the first fluxions of their ordinates: And if, besides the first fluxions of these ordinates, their second fluxions, for the same abscissa, are also equal; it will be impossible that any other curve which passes through the common point can go between them, unless the first and second fluxions of its ordinate are respectively equal to the first and second fluxions of the ordinate common to the two curves, and so on of the higher orders of fluxions.

In fact, the two curves only coincide in the points in which their ordinates are equal; and the equality of the different orders of fluxions merely shews, that no other curve, in which the same equality has not place, can pass between them. This is the view that ought to be taken of the contact of curves; and it agrees with the doctrine of the ancient geometers, as far as they entered into this theory; for they considered a straight line as a tangent to a curve, when no other straight line could be drawn between them from the point in which they met each other. (*Elements of Euclid*, Book III. Prop. 16.) The application of Algebra to Geometry, has led to other views, particularly that in which a secant is considered as becoming a tangent, when two of its intersections coincide. As this manner of considering the subject is simple, and sufficiently strict, we have employed it in treating of the theory of tangents. (Art. 67.)

ig. 8.

84. As an illustration of this theory, let us consider the nature of the contact of any curve CPD, (Fig. 8.) and a straight line TP, supposing A to be the origin of the common abscissa. Let AQ $=x$; and PQ (taken as any ordinate of the curve CD) $=y$, also PQ (taken as any ordinate of the straight line TP) $=v$; Put TA $=a$, and tangent of angle T $=t$; then the equation to the straight line PT is evidently $v=t(a+x)=ta+tx$; hence, as a and t are constant, we have, for every point in the straight line TP, $dv=t\,dx$, and $\frac{dv}{dx}=t$. As besides the straight line and curve having a common point at P, which is expressed by the equation $v=y$, we farther suppose the nature of the contact to be such, that $\frac{dv}{dx}=\frac{dy}{dx}$; it follows that $\frac{dy}{dx}=t$. This result agrees with what we found in art. 67, formula (1), and thence the subtangent TQ may be determined, as was there explained.

The line PT being thus determined, it is impossible that any straight line can be drawn from P, that shall pass between PT and the curve: For, if possible, let the line PS pass between them, and meet the axis in S. Put AS $=a'$; tangent of angle S $=t'$; PQ (considered as an ordinate of PS) $=u$; then the equation of the line PS is $u=t'(a'+x)$, and hence $\frac{du}{dx}=t'$: Now, in order that the line PS may pass between the curve and the straight line PT, it ought to satisfy the condition $\frac{du}{dx}=\frac{dy}{dx}$ (art. 81.): hence we must have $t'=t$, that is the tangent of the angles PTA, and PSA must be equal, which can only happen when the lines PT, PS coincide; Thus the line PT is a tangent according to the strictest acceptation of the term.

85. Let us now consider the contact of a circle and any curve; let the circle EPF meet the curve CPD in the point P, (Fig. 22.) Suppose that AB is their common axis, and A the origin of the common abscissa AQ $=x$; then put $y=$ PQ, considered as an ordinate of the curve CPD; and $v=$ PQ, considered as an ordinate of the circle EPF. Let H be the centre of the circle; draw the radius HP, and draw HI, HK perpendicular to PQ and AB. Put $r=$ PH, $p=$ AK, $q=$ HK, so that p and q are the co-ordinates of the centre of the circle, then HI $=p-x$, and PI $=v-q$; and since, from the nature of the circle, $\text{PH}^2=\text{PI}^2+\text{HI}^2$; therefore

Fig. 22.

$$(p-x)^2+(v-q)^2=r^2. \qquad (1.)$$

First let us suppose that the kind of contact is such as is indicated by the equality of the first fluxions of the ordinates; so that $\frac{dy}{dx}=\frac{dv}{dx}$. The preceding equation, in which p, q and r are to be considered as constant quantities, and v as a function of x, gives us $-2(p-x)\,dx+2(v-q)\,dv=0$, and hence

$$\frac{dv}{dx}=\frac{p-x}{v-q}. \qquad (2.)$$

Now $\frac{p-x}{v-q}=\frac{\text{HI}}{\text{PI}}=\frac{\text{QN}}{\text{PQ}}=\frac{\text{QN}}{v}$; therefore, $\frac{dv}{dx}=\frac{\text{QN}}{v}$; and $\frac{dv}{dx}v=\text{QN}$; and since by hypothesis, $v=y$ and $\frac{dv}{dx}=\frac{dy}{dx}$; therefore $\frac{dy}{dx}y=\text{QN}$. But this expression for QN is identical with that given in art. 67, for the subnormal of a curve; therefore QN is the subnormal, and consequently the centres of all circles, which have the kind of contact we are considering, are in a *normal* to the curve at the common point P.

When a circle has this kind of contact with a curve, no other circle of an equal radius, but whose centre is out of the normal, can pass between it and the curve. For, supposing it possible, let p' and q' be the co-ordinates of the centre of this other circle, and u its ordinate to the abscissa x; then, in like manner, as in the former circle, we have found

$$\frac{dv}{dx}=\frac{p-x}{v-q}=\frac{p-x}{\sqrt{\left\{r^2-(p-x)^2\right\}}};$$

in the other circle, we must similarly have

$$\frac{du}{dx}=\frac{p'-x}{\sqrt{\left\{r^2-(p'-x)^2\right\}}}.$$

And as upon the hypothesis that this last circle passes between the other circle and the curve, we ought to have $\frac{du}{dx}=\frac{dy}{dx}=\frac{dv}{dx}$ (art. 81.) therefore

$$\frac{p-x}{\sqrt{\left\{r^2-(p-x)^2\right\}}}=\frac{p'-x}{\sqrt{\left\{r^2-(p'-x)^2\right\}}}.$$

This equation gives $p'=p$, from which it follows, that $q'=q$, so that the two circles have their centres at the same point, and therefore are identical.

The kind of contact which we have been considering, which is analogous to the contact of a straight line and curve, may be called a *contact of the first order*.

86. Let us next suppose the curve and circle to have a closer degree of contact, so that not only is $y=v$, and $\frac{dy}{dx}=\frac{dv}{dx}$; but also $\frac{d^2y}{dx^2}=\frac{d^2v}{dx^2}$.

From the second equation of last article we find

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$$\frac{d^2v}{dx}=-\frac{(v-q)\,dx+(p-x)\,dv}{(v-q)^2};$$

instead of dv substitute its value $\frac{p-x}{v-q}\,dx$, as given by the same equation, and moreover, put r^2 instead of $(p-x)^2+(v-q)^2$, as given by the first equation, and then, after dividing by dx, we get

$$\frac{d^2v}{dx^2}=-\frac{r^2}{(v-q)^3}.$$

This equation, as well as equations (1) and (2) in the last article, are derived from the properties of the circle; but as we suppose $v=y$ and $\frac{dv}{dx}=\frac{dy}{dx}$, and lastly, $\frac{d^2v}{dx^2}=\frac{d^2y}{dx^2}$, the same three equations relatively to the curve CPD will stand thus:

$$(p-x)^2+(y-q)^2=r^2 \qquad (1)$$

$$\frac{dy}{dx}=\frac{p-x}{y-q}, \qquad (2)$$

$$\frac{d^2y}{dx^2}=-\frac{r^2}{(y-q)^3}, \qquad (3)$$

From the first and second of these equations we find

$$p-x=\frac{r\,dy}{(dx^2+dy^2)^{\frac{1}{2}}}; \qquad (4)$$

$$y-q=\frac{r\,dx}{(dx^2+dy^2)^{\frac{1}{2}}}; \qquad (5)$$

and again, from this last, and equation (3),

$$r=-\frac{(dx^2+dy^2)^{\frac{3}{2}}}{dx\,d^2y}. \qquad (A)$$

This value of r being substituted in equations (4) and (5), we deduce from them these results

$$p=x-dy\,\frac{dx^2+dy^2}{dx\,d^2y}, \qquad (B)$$

$$q=y+\frac{dx^2+dy^2}{d^2y}. \qquad (C)$$

The three constant quantities p, q, r, which enter into the general equation of a circle, being thus determined, it may be concluded that no other circle can pass between the curve and that which is determined by these values of p, q, r. For if it be possible, let u be the ordinate in that other circle corresponding to the abscissa x, r' its radius, and p', q' the co-ordinates of its centre; then its equation would be

$$(p'-x)^2+(u-q')^2=r'^2.$$

Now, that this circle may pass between the curve and the other circle, it is necessary that $u=y$, $\frac{du}{dx}=\frac{dy}{dx}$, $\frac{d^2u}{dx^2}=\frac{d^2y}{dx^2}$. But these being the very same conditions which are satisfied by the other circle, they will give the same values for p', q', r', as we have found for p, q, r; and so the two circles must coincide.

This circle has relatively to other circles the same property which a tangent has in respect of straight lines. It is that which geometers have called the *osculating circle*; also the *circle of curvature*, because it serves to measure the curvature of the curve. The quantity r, the radius of the circle, is called the *radius of curvature*.

87. The centre of the circle of curvature being different for different points of a curve, there is a certain line LM, belonging to the curve, which is the *locus* of all the centres. The quantities p, q are manifestly co-ordinates to any point H of this *locus*, and its nature is expressed by the two equations (B), (C). In any given curve, the values of y, dy and d^2y may be all expressed by x and dx, and these being substituted in the expressions for p and q, they will involve only the indeterminate quantity x, which may be eliminated by means of the two equations, and the result will be an equation involving only p, q and known quantities, which will be an equation of the locus of the centre of the circle of curvature.

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88. Formula (A) of last article serves to find the radius of curvature, when the nature of the curve is indicated by the relation of the rectangular co-ordinates: But let us now suppose, that its nature is defined by an equation expressing the relation between AE $=p$, a perpendicular from any given point in the axis BA upon a tangent at P and the angle BAE $=u$, which that perpendicular makes with the axis (Fig. 18.) Draw the normal PN, and let x and y be the rectangular co-ordinates of the point P. The angle at N $=u$ is manifestly the compliment of the angle which the tangent makes with the axis; hence $\frac{dy}{dx}=\cot. u$ (formula (1), art. 67.) and taking the fluxions considering u and y as functions of x, $\frac{d^2y}{dx}=\frac{-du}{\sin.^2 u}=-du\,\text{cosec.}^2 u$ (art. 34.) but $\text{cosec.}^2 u=1+\text{cotan.}^2 u=\frac{dx^2+dy^2}{dx^2}$; therefore $dx\,d^2y=-du\,(dx^2+dy^2)=-du\,dz^2$ (putting z for the curve and observing that $dz^2=dx^2+dy^2$, art. 75.) and since by formula (A), last art.

Fig. 18.

$$r=-\frac{(dx^2+dy^2)^{\frac{3}{2}}}{dx\,d^2y}=-\frac{dz^3}{dx\,d^2y}, \text{ therefore,}$$

$$r=\frac{dz}{du}. \qquad (A')$$

Here we have a very simple expression for the radius of curvature, from which it appears *to be equal to the fluxion of the arc divided by the fluxion of the angle which the normal makes with the axis.*

And as we have found (art. 77.) that $dz=p\,du+\frac{d^2p}{du}$, therefore

$$r=p+\frac{d^2p}{du^2}. \qquad (A'')$$

This is the expression for r which we proposed to investigate.

89. We shall now shew the application of the formulæ we have found for the radius of curvature.

Ex. 1. Let the curve be a parabola (Fig. 23.) and let A, the vertex of the axis AB, be the origin of the co-ordinates AQ $=x$, and QP $=y$. Let a be the parameter of the axis, then, by the nature of the curve, $y^2=ax$, hence $y=a^{\frac{1}{2}}x^{\frac{1}{2}}$, and $dy=\frac{a^{\frac{1}{2}}dx}{2x^{\frac{1}{2}}}$ and $d^2y=-\frac{a^{\frac{1}{2}}dx^2}{4x^{\frac{3}{2}}}$. Therefore, $dx^2+dy^2=dx^2+\frac{a\,dx^2}{4x}=\frac{dx^2(4x+a)}{4x}$; and by formula (A), art. 86,

Fig. 23.

$$r=-\frac{(dx^2+dy^2)^{\frac{3}{2}}}{dx\,d^2y}=\frac{(a+4x)^{\frac{3}{2}}}{2\sqrt{a}}.$$

If $x=0$, then $r=\frac{1}{2}a$; this is the radius of curvature at the vertex.

As an example of the application of the third formula for the radius of curvature, let us again take the parabola, and let F be the focus, and FE a perpendicular to the tangent PE. Draw a straight line from E to A, the vertex of the axis; then AE is a tangent at the vertex, (CONIC SECTIONS, Sect. IV. Prop. 14. cor. 1,) and therefore FAE is a right angled triangle. Hence, putting FE $= p$, and the angle AFE $= u$, and observing that AF $= \frac{1}{4}$ parameter $= \frac{1}{4}a$, we have for the equation of the curve

$$p = \frac{a}{4\cos. u}.$$

And taking the fluxions, by art. 30. and art. 26. observing that p is a function of u,

$$\frac{dp}{du} = \frac{a\sin. u}{4\cos.^2 u}, \quad \frac{d^2p}{du^2} = \frac{(\cos.^2 u + 2\sin.^2 u)a}{4\cos.^3 u}.$$

Therefore, by formula (A″), art. 88.

$$r = p + \frac{d^2p}{du^2} = \frac{2(\cos.^2 u + \sin.^2 u)a}{4\cos.^3 u} = \frac{a}{2\cos.^3 u};$$

and hence we have also $r = \frac{32p^3}{a^2}$.

Ex. 2. Let the curve be any one of the conic sections. If the origin of the co-ordinates be taken at one extremity of the principal axis, their nature may be expressed by the equation

$$y^2 = mx + nx^2.$$

Hence we find,

$$dy = \frac{(m+2nx)dx}{2y},$$

$$dx^2 + dy^2 = \frac{\left\{4y^2 + (m+2nx)^2\right\}dx^2}{4y^2},$$

$$= \frac{\left\{4(mx+nx^2) + (m+2nx)^2\right\}dx^2}{4y^2},$$

$$d^2y = \frac{2ny\,dx^2 - (m+2nx)dx\,dy}{2y^2},$$

$$= \frac{\left\{4ny^2 - (m+2nx)^2\right\}dx^2}{4y^3}.$$

Hence, from formula (A), we get

$$r = -\frac{\left\{4y^2 + (m+2nx)^2\right\}^{\frac{3}{2}}}{8ny^2 - 2(m+2nx)^2},$$

and substituting for y^2 its value,

$$r = \frac{\left\{4(mx+nx^2) + (m+2nx)^2\right\}^{\frac{3}{2}}}{2m^2}.$$

By giving to m and n the values that belong to the different curves, (CONIC SECTIONS, Sect. VIII.) this formula will give the radius of curvature in each case.

90. It appears from what has been shewn in this section, that the contacts of curve lines may be arranged according to different orders. The degree of contact, in which the ordinates, and also their first fluxions, are equal, (art. 81.) may be called a contact of the *first order*; and when in addition to these, the second fluxions are equal, (art. 82,) it is a contact of the *second order*; and so on.

There are curves which, with a given curve, admit only of contacts of a certain order. A straight line, for instance, is only capable of a contact of the first order. A circle may have a contact of the first, and also of the second order, but none higher; and a curve, whose equation is $y = a + bx + cx^2 + dx^3$, is also capable of a contact of the third order; and so on. The degree of contact of which a curve is capable, depends upon the number of constant quantities to be determined. These may be called the *elements of contact*. A contact of the first order requires two constant quantities; a contact of the second requires three; and so of the higher orders.

In an analytical point of view, the contact of a straight line, or of a circle with a curve, is not more interesting than the contact of any other curve, unless on account of these curves being more elementary. The circle of curvature is, however, interesting, because of the simple geometrical expression it gives for the measure of a deflecting force. (*Principia*, lib. i. prop. vi. See also *Physical* ASTRONOMY, chap. i.)

91. The first formula which we have given for the radius of curvature, (art. 86,) has been investigated upon the hypothesis, that the curve is concave towards the axis. In this case, $\frac{d^2y}{dx^2}$ is a negative quantity; and hence the sign of the expression for r is negative. If the curve had been convex towards the axis, then the sign of $\frac{d^2y}{dx^2}$, and of the expression for r, would have been positive. Upon the first hypothesis, r comes out a positive quantity in the applications of the formula, as in the examples we have given; but when the curve is convex towards the axis, it has a negative value.

Of the Evolutes of Curves.

Fig. 24.

92. Let LHM be a curve of any kind, (Fig. 24.) and let us suppose that a thread, fastened to the curve at some point beyond M, is drawn tight, and applied upon it, so as to have the position CLOM; that this may be done, the curve may be conceived to be the common section of a plane, and some solid rising a little above it, round which the thread is wound. Suppose now, that while the thread is kept tight, it is gradually unlapped from the curve. While the portion between L and H is unwinding, its extremity P will describe upon the plane some line CP, and the process of unwinding being continued, a curve CPD will be generated, the nature of which will depend on the mode of its generation, and the properties of the other curve LHM.

The curve along which the thread is wrapped, is called the *Evolute* of the curve, generated by the extremity of the thread; and, on the other hand, the latter curve is called the *Involute* of the former. Our present object is to shew, how the evolute of any proposed curve CPD may be found.

93. From the manner in which a curve is generated from its evolute, we may immediately draw these three conclusions:

1. The portion of the thread PH, which is disengaged from the evolute, is a tangent to it at H.

2. The straight line PH, is equal to the arc CH of the evolute.

3. Any tangent to the evolute, is a normal to the curve. In fact, any point H of the evolute may be considered as a momentary centre; and the line HP as the radius of a circle which the point P is describing, when the point of contact of the tangent and curve is at H. It is from this last property, that we propose to deduce a solution of our problem.

Let AB be a common axis to the two curves, and let the normal PH produced meet the axis in N. Let P′H′N′ be another position of the normal, meeting the

Direct Method.

former in O. Draw PG, P′G, tangents to the curve, meeting in G, (these lines will be perpendicular to PO, P′O,) and join GO. Put z for the arc CP, u for the angle which the normal makes with the axis at N, and r for PH, the portion of the thread evolved from the arc CH. By trigonometry, PG=OG × sin. POG, and P′G=OG × sin. P′OG; therefore,

$$\frac{\mathrm{PG}+\mathrm{P'G}}{\sin.\,\mathrm{POG}+\sin.\,\mathrm{P'OG}}=\mathrm{OG}.$$

Conceive now the point P′ to approach P, then O will approach to H, and the line OG will approach in magnitude to HP=r, which will be its limit; also the fraction to which OG is equal, will approach to $\frac{\text{arc PP}'}{\text{angle POP}'}$ (art. 73.) Hence, remarking that the arc PP′, and the angle POP′, are the corresponding increments of z and u, and passing to the limits, we have (art. 23.) $\frac{dz}{du}=r$. But this value of r, is the very expression which we have found for the radius of curvature, (formula (A′), art. 88.) Therefore, r is the radius of curvature, at P; and because PH is a normal to the curve, H is the centre of the circle of curvature; and the evolute LOM is the *locus* of the centre of that circle. Hence, if AQ=x, and PQ=y, be the co-ordinates of P, any point in the curve CPD, and AK=p, and KH=q, the co-ordinates of H, the corresponding point in the evolute, by art. 86. formulæ (B), (C), its equation will be,

$$p=x-\frac{dy}{dx}\,\frac{dx^2+dy^2}{d^2y},\quad q=y+\frac{dx^2+dy^2}{d^2y}.$$

For example, if the curve CPD be a parabola, then putting a for the parameter, in this case $y^2=a\,x$; and hence, $d\,y=\frac{a\,d\,x}{2\,y}$, $d^2y=-\frac{a^2dx^2}{4\,y^3}$ and

$$p=3x+\tfrac{1}{2}a,\qquad q=-\frac{4\,y^3}{a^2}.$$

As q comes out negative, the parabolic arc and its evolute lie on opposite sides of the axis. Moreover, since $\frac{2\,a\,p-a^2}{6}=a\,x$, and $\left(\frac{a^2q}{4}\right)^{\frac{2}{3}}=y^2=a\,x$, we easily find,

$$27\,a\,q^2=16(p-\tfrac{1}{2}a)^3.$$

This equation belongs to the semicubical parabola.

94. The theory of evolutes, one of the most elegant speculations in geometry, is due to Huygens, who handled it at considerable length in his *Horologium Oscillatorium*. We have seen, that it is closely connected with the theory of contacts; and indeed, it is usual to define the circle of curvature, from the property of its radius being equal to the evolving radius. We have, however, after Lagrange, followed a method more strictly analytical. We might have deduced the properties of evolutes, from the formulæ in art. 86, for the centre and radius of curvature; but as a more elementary mode, we have chosen to prove the identity of the *evolute*, and the *locus* of the centre of the circle of curvature, by employing the principle which originally led to the theory.

As the radius of curvature is always equal to the arc of the evolute, from which it has been unwrapped; and as in geometrical curves, that radius is in every case an algebraic expression, of a finite number of terms, and the evolute also a geometrical curve; it follows, that to every geometrical curve whatever, there is a corresponding geometrical curve which may be rectified; that is, to which a straight line can be found equal. This was proved by Huygens; and it shewed, that Descartes was wrong in supposing, that it was impossible to find a straight line equal to a curve.

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For the evolutes of the cycloid and epicycloid, see our article EPICYCLOID.

Of changing the Independent Variable Quantity.

95. We have all along supposed x to vary in any manner whatever, and estimated the change that takes place in y, any function of x, by referring it to the change in the magnitude of x, which, on that account, was the independent variable quantity. It is sometimes convenient, however, to vary the hypothesis, and pass from the supposition of y being a function of x, to that of x being a function of y.

The form of a fluxional expression depends very much upon the quantity that is regarded as the independent variable. Thus in art. 67, we have found, that if s denote the sub-tangent of a curve, and x and y the co-ordinates, then $s=\frac{dx}{dy}y$; and this is true, whether y be considered as a function of x, or x as a function of y. From this expression, by regarding s and y as functions of x, (so that $d\,x$ is constant,) we have

$$d\,s=\frac{d\,x(dy^2-y\,d^2y)}{d\,y^2}=d\,x-\frac{y\,d\,x\,d^2y}{d\,y^2}.$$

If, however, we reckon s and x as functions of y, then as $d\,y$ must be now constant, we have $d\,s=d\,x+\frac{yd^2x}{dy}$, an expression quite different from the former. We are now to investigate general rules, by which, in such cases, the one expression may be deduced from the other.

96. Let $y=f\,(x)$, and let us suppose, that when x becomes $x+h$, then y becomes $y+k$. By Taylor's theorem,

$$k=\frac{dy}{dx}h+\frac{d^2y}{d\,x^2}\,\frac{h^2}{2}+\frac{d^3y}{d\,x^3}\,\frac{h^3}{2.3}+\&c. \qquad (1.)$$

But let us now suppose, that from the equation $y=f(x)$, we deduce $x=\mathrm{F}(y)$, so that x is a function of y; then similarly,

$$h=\frac{dx}{dy}k+\frac{d^2x}{dy^2}\,\frac{k^2}{2}+\frac{d^3x}{dy^3}\,\frac{k^3}{2.3}+\&c. \qquad (2.)$$

Let the value of k, as expressed by the first equation, be substituted in the second; and, with a view to abridge, let us put

$$y' \text{ for } \frac{dy}{dx},\ y'' \text{ for } \frac{d^2y}{d\,x^2}\ \&c.\ \text{also } x' \text{ for } \frac{dx}{dy},$$

$$x'' \text{ for } \frac{d^2x}{d\,y^2},\ \&c.\ \text{and we have}$$

$$h=x'(y'h+y''\frac{h^2}{2}+y'''\,\frac{h^3}{2.3}+\&c.)$$

$$+\frac{x''}{2}(y'\,h+y''\frac{h^2}{2}+y'''\,\frac{h^3}{2.3}+\&c.)^2$$

$$+\frac{x'''}{6}(y'h+y''\,\frac{h^2}{2}+y'''\,\frac{h^3}{2.3}+\&c.)^3+\&c.$$

Hence, by actually involving the series to the 2d, the 3d powers, &c. and bringing together like powers of h, we find

$$0=(x'\,y'-1)\,h+(x'\,y''+x''\,y'^2)\frac{h^2}{2}$$

$$+(x'\,y'''+3x''\,y'\,y''+x'''\,y')\frac{h^3}{6}+\&c.$$

Now, as h is altogether independent of x', x'', &c. y', y'', &c. the coefficients of its powers must be each $=0$, hence

$$x'y'-1=0,\quad x'y''+x''y'^2=0,$$
$$x'y'''+3x''y'y''+x'''y'=0,\ \&c.$$

from which equations, we get

$$y'=\frac{1}{x'},\ y''=-\frac{x''}{x'^3},\ y'''=\frac{3x''^2}{x'^5}-\frac{x'''}{x'^4},$$
$$y^{\text{iv}}=\frac{15x''^3}{x'^7}+\frac{10x''x'''}{x'^6}-\frac{x^{\text{iv}}}{x'^5};\ \&c.$$

and, on the other hand,

$$x'=\frac{1}{y'},\ x''=-\frac{y''}{y'^3},\ x'''=\frac{3y''^2}{y'^5}-\frac{y'''}{y'^4},$$
$$x^{\text{iv}}=\frac{15y''^3}{y'^7}+\frac{10y''y'''}{y'^6}-\frac{y^{\text{iv}}}{y'^5},\ \&c.$$

97. In finding the first formula for the radius of curvature, viz. $r=-\frac{(dx^2+dy^2)^{\frac{3}{2}}}{dx\cdot d^2y}$, we have regarded x as the independent variable quantity. Now, to shew the use of the formulæ investigated in last article, let it be required to transform it into another, in which y shall be the independent variable quantity. In the first place, employing the notation of last article,

$$r=-\frac{\left\{1+\frac{dy^2}{dx^2}\right\}^{\frac{3}{2}}}{\frac{d^2y}{dx^2}}=-\frac{(1+y'^2)^{\frac{3}{2}}}{y''}.$$

Now, by the preceding article, to pass from the hypothesis of y, a function of x, to that of x, a function of y, we must make $y'=\frac{1}{x'}$, and $y''=-\frac{x''}{x'^3}$. This substitution being made, we find

$$r=\frac{(x'^2+1)^{\frac{3}{2}}}{x''}=\frac{(dx^2+dy^2)^{\frac{3}{2}}}{dy\,d^2x}.$$

The second of these expressions is got from the other, by substituting $\frac{dx}{dy}$ for x', and $\frac{d^2x}{dy^2}$ for x''.

98. Sometimes it is necessary to consider both x and y (a function of x) as functions of some third quantity t; and in this view of the matter, neither the fluxions of x nor y can be considered as constant. For example, in mechanics, we may consider x and y, the co-ordinates of the path of a projectile, as functions of t, the time of the motion.

Let us suppose, that when t becomes $t+i$, then x becomes $x+k$, and y becomes $y+k$; and to abridge, let us denote

$$\frac{dx}{dt},\ \frac{d^2x}{dt^2},\ \&c.\ \text{by}\ x',\ x'',\ \&c.$$
$$\frac{dy}{dt},\ \frac{d^2y}{dt^2},\ \&c.\ \text{by}\ y',\ y'',\ \&c.$$
$$\frac{dy}{dx},\ \frac{d^2y}{dx^2},\ \&c.\ \text{by}\ (y'),\ (y''),\ \&c.$$

Then, by Taylor's theorem,

$$y=f(x)\ \text{gives}\ k=(y')h+(y'')\frac{h^2}{2}+\&c. \qquad (1.)$$
$$y=\mathrm{F}(t)\ \text{gives}\ k=y'i+y''\frac{i^2}{2}+\&c. \qquad (2.)$$
$$x=\varphi(t)\ \text{gives}\ h=x'i+x''\frac{i^2}{2}+\&c. \qquad (3.)$$

As the increments k, h, i, are all generated together, in consequence of a change in the value of t, these three equations must all hold true at once. Therefore, by substituting the value of h, as given by the third equation in the first, and then putting the two values of k equal to each other, we get

$$(y')\left\{x'i+x''\frac{i^2}{2}+\&c.\right\}$$
$$+\frac{(y'')}{2}\left\{x'i+x''\frac{i^2}{2}+\&c.\right\}^2+\&c.$$
$$=y'i+y''\frac{i^2}{2}+\&c.$$

Hence, by finding the second power, &c. of the series, and putting the co-efficients of the powers of $i=0$, we find

$$x'(y')=y',\ x''(y')+x'^2(y'')=y'',\ \&c.$$

therefore, $(y')=\frac{y'}{x'}$, $(y'')=\frac{y''-x''(y')}{x'^2}$, &c.

99. Let us again take the formula for the radius of curvature, as an example, which, when expressed in conformity to the notation of last article, will be $r=-\frac{\left\{1+(y')^2\right\}^{\frac{3}{2}}}{(y'')}$. By substituting for (y') and (y'') their values, the formula becomes $-\frac{(x'^2+y'^2)^{\frac{3}{2}}}{x'y''-y'x''}$, and reverting to the usual notation, (putting $\frac{dx}{dt}$ for x', $\frac{dy}{dt}$ for y', $\frac{d^2x}{dt^2}$ for x'', and $\frac{d^2y}{dt^2}$ for y'', we find

$$r=-\frac{(dx^2+dy^2)^{\frac{3}{2}}}{dx\,d^2y-dy\,d^2x}.$$

Here the fluxions are supposed to be taken relatively to a quantity t, which does not indeed appear in the formula, but nevertheless it must be kept in view.

Of the Fluxions of Functions, which contain two Independent Variable Quantities.

100. We have hitherto considered only functions of a single variable quantity; and this is the most common case; but a function may involve two or more variable quantities, which are quite independent of each other. In geometry, if we suppose any point on the surface of a sphere, to be referred to three planes perpendicular to each other, which pass through its centre, and put x, y, z, for the co-ordinates of that point, and a for the radius; the equation of the surface is $x^2+y^2+z^2=a^2$. (CURVE LINES.) Here each of the quantities x, y, z, may be considered as a function of the other two, which may vary independently of one another.

Let u be any function whatever of two independent variable quantities x, y; or, following the notation of art. 45, let $u=f(x,y)$; and let x and y change their values, so that x becomes $x+h$, and y becomes $y+k$, h and k, however, being supposed quite independent of one another. By the change in the value of x, z becomes $f(x+h,y)$; and again, in consequence of y also changing its value, it becomes $f(x+h,y+k)$. Now, if we first develope $f(x+h,y)$, supposing x variable, and y constant, and then substitute in that partial developement $y+k$ for y, we shall evidently have the complete developement of $(x+h,\ y+k)$. Or we may reverse

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the process, first developing $f(x, y+k)$, considering x as constant, and then substituting $x+h$ in the result instead of x; and by either method, we shall evidently arrive at the same final result, as if we were to substitute at once $x+h$ for x, and $y+k$ for y, in the function u.

Proceeding according to the first of these methods; and supposing that x alone changes its value, we have

$$f(x+h,y)=u+\frac{du}{dx}h+\frac{d^2u}{dx^2}\,\frac{h^2}{2}+\frac{d^3u}{dx^3}\,\frac{h^3}{2.3}+\text{\&c.}$$

In this developement, y enters into the functions u, $\frac{du}{dx}$, $\frac{d^2u}{dx^2}$, &c. exactly as if it were a constant quantity: But let us now suppose y to become $y+k$, by which $f(x+h, y)$ becomes $f(x+h, y+k)$, then, relatively to this change in the value of y, u becomes

$$u+\frac{du}{dy}k+\frac{d^2u}{dy^2}\,\frac{k^2}{2}+\frac{d^3u}{dy^3}\,\frac{k^3}{2.3}+\text{\&c.}$$

and $\frac{du}{dx}$ becomes

$$\frac{du}{dx}+\frac{d\left(\frac{du}{dx}\right)}{dy}\,\frac{k}{1}+\frac{d^2\left(\frac{du}{dx}\right)}{dy^2}\,\frac{k^2}{2}+\text{\&c.}$$

But it is easy to see, that the expression $\frac{d\left(\frac{du}{dx}\right)}{dy}$ indicates, that the fluxion of u is to be taken twice, first relatively to x alone, and then relatively to y; it may therefore be more simply written thus $\frac{d^2u}{dy\,dx}$. In like manner, $\frac{d^2\left(\frac{du}{dx}\right)}{dy^2}$, which means that the fluxion of u is to be taken once relatively to x, and twice relatively to y, may be written thus $\frac{d^3u}{dy^2dx}$.*

In general, $\frac{d^{n+m}u}{dy^n dx^m}$ means the fluxional coefficient of the nth order of the function $\frac{d^m u}{dx^m}$, in which y alone is considered as the variable quantity, and again $\frac{d^m u}{dx^m}$ means the fluxional coefficient of the mth order, taken upon the hypothesis that x only is variable. This being understood, when y becomes $y+k$, then $\frac{du}{dx}$ becomes

$$\frac{du}{dx}+\frac{d^2u}{dy\,dx}k+\frac{d^3u}{dy^2dx}\,\frac{k^2}{2}+\text{\&c.}$$

and $\frac{d^2u}{dx^2}$ becomes

$$\frac{d^2u}{dx^2}+\frac{d^3u}{dy\,dx^2}k+\frac{d^4u}{dy^2dx^2}\,\frac{k^2}{2.3}+\text{\&c.}$$

and so on for $\frac{d^3u}{dx^3}$, &c.

These values of u, $\frac{du}{dx}$, $\frac{d^2u}{dx^2}$, &c. being substituted in the developement of $f(x+h, y)$, we get

$$f(x+h,\ y+k)=$$

$$\begin{aligned}
u&+\frac{du}{dy}k+\frac{d^2u}{dy^2}\,\frac{k^2}{2}+\frac{d^3u}{dy^3}\,\frac{k^3}{2.3}+\text{\&c.}\\
&+\frac{du}{dx}h+\frac{d^2u}{dy\,dx}kh+\frac{d^3u}{dy^2dx}\,\frac{k^2h}{2}+\text{\&c.}\\
&\qquad+\frac{d^2u}{dx^2}\,\frac{h^2}{2}+\frac{d^3u}{dy\,dx^2}\,\frac{kh^2}{2}+\text{\&c.}\\
&\qquad\qquad+\frac{d^3u}{dx^3}\,\frac{h^3}{2.3}+\text{\&c.}\\
&\qquad\qquad\qquad+\text{\&c.}
\end{aligned}$$

This is the complete developement of the new value of the function u.

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101. According to the other method, supposing x to remain the same, and y to become $y+k$, the corresponding value of u will be $f(x, y+k)=$

$$u+\frac{du}{dy}k+\frac{d^2u}{dy^2}\,\frac{k^2}{2}+\frac{d^3u}{dy^3}\,\frac{k^3}{2.3}+\text{\&c.}$$

Here x enters into the functions u, $\frac{du}{dy}$, &c. as a constant quantity; but suppose now, that x changes its value, and becomes $x+h$, then u will become

$$u+\frac{du}{dx}h+\frac{d^2u}{dx^2}\,\frac{h^2}{2}+\text{\&c.}$$

Also, (employing the same mode of notation as in the other developement,) $\frac{du}{dy}$ will become

$$\frac{du}{dy}+\frac{d^2u}{dx\,dy}h+\frac{d^3u}{dx^2dy}\,\frac{h^2}{2}+\text{\&c.}$$

and $\frac{d^2u}{dy^2}$ will change to

$$\frac{d^2u}{dy^2}+\frac{d^3u}{dx\,dy^2}h+\frac{d^4u}{dx^2dy^2}\,\frac{h^2}{2}+\text{\&c.}$$

and so on for $\frac{d^3u}{dy^3}$, &c. These new values of u, $\frac{du}{dy}$, &c. being substituted in the developement of $f(x, y+k)$, we have $f(x+h, y+k)=$

$$\begin{aligned}
u&+\frac{du}{dx}h+\frac{d^2u}{dx^2}\,\frac{h^2}{2}+\frac{d^3u}{dx^3}\,\frac{h^3}{2.3}+\text{\&c.}\\
&+\frac{du}{dy}k+\frac{d^2u}{dx\,dy}hk+\frac{d^3u}{dx^2dy}\,\frac{h^2k}{2}+\text{\&c.}\\
&\qquad+\frac{d^2u}{dy^2}\,\frac{k^2}{2}+\frac{d^3u}{dx\,dy^2}\,\frac{hk^2}{2}+\text{\&c.}\\
&\qquad\qquad+\frac{d^3u}{dy^3}\,\frac{k^3}{2.3}+\text{\&c.}\\
&\qquad\qquad\qquad+\text{\&c.}
\end{aligned}$$

This also is the complete developement of the function u.

102. If we compare, in these two developements, the terms which contain the same powers of h and k, we shall find this series of equations, $\frac{d^2u}{dy\,dx}=\frac{d^2u}{dx\,dy}$, $\frac{d^3u}{dy\,dx^2}=\frac{d^3u}{dx^2dy}$, and in general $\frac{d^{n+m}u}{dy^n dx^m}=\frac{d^{n+m}u}{dx^m dy^n}$

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* To exemplify this notation, let $u=x^3y^2$, then $\frac{du}{dx}=3x^2y^2$; $\frac{d^2u}{dy\,dx}=6x^2y$; $\frac{d^3u}{dy^2dx}=6x^2$: Also, $\frac{d^2u}{dx^2}=6xy^2$, $\frac{d^3u}{dy\,dx^2}=12xy$, &c.

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The first of these equations shews, *that the fluxional coefficient of the second order of a function, containing two variable quantities, taken first relatively to the one, and then relatively to the other, is the very same, in whatever order we proceed in finding the fluxions.* This is an important theorem in the calculus. To exemplify this property, let $u=x^m y^n$, then, taking the fluxion in respect of x, we find $\frac{du}{dx}=m x^{m-1} y^n$; and again, taking the fluxion in respect of y, $\frac{d^2 u}{dy\,dx}=m n x^{m-1} y^{n-1}$. By proceeding in the contrary order, we find $\frac{du}{dy}=n x^m y^{n-1}$, and $\frac{d^2 u}{dx\,dy}=m n x^{m-1} y^{n-1}$, the same result as before.

The other equations given above are merely consequences of the first.

103. As, by the transition of a single variable quantity from one state of magnitude to another, there originates from any function of that quantity a series of other functions, which are denominated its fluxional coefficients, (Art. 23. and 41.); a function of two independent variable quantities must have an analogous property. If we compare the developement of a function of a single variable quantity (Art. 52.) with that of a function of two independent variable quantities (Art. 100. and 101.), we see immediately wherein that analogy consists. In the former case, when x becomes $x+h$, u any function of x, becomes $u+\frac{du}{dx}h+\frac{d^2u}{dx^2}\frac{h^2}{2}+$ &c.; and in the latter, u being a function of the independent quantities x and y, when x becomes $x+h$, and y becomes $y+k$; then u becomes $u+\frac{du}{dx}h+\frac{du}{dy}k+\frac{d^2u}{dx^2}\frac{h^2}{2}+\frac{d^2u}{dx\,dy}hk+\frac{d^2u}{dy^2}\frac{k^2}{2}+$ &c. As in the former case, the coefficient of the simple power of the increment h is the *fluxional coefficient* of the function; in the latter, the coefficients of the simple powers of the two increments h and k, may be regarded as the *fluxional coefficients* of the function: So that, while in a function of a single variable quantity, there is only one fluxional coefficient of the first order; in a function of two independent variable quantities there are two, one $\frac{du}{dx}$, which is relative to x, and another $\frac{du}{dy}$, relative to y.

Moreover, as when u is a function of a single variable quantity, the fluxion of u is indicated by multiplying its fluxional coefficient by dx, (the symbol for the fluxion of x,) so that the fluxion of the function may be expressed thus $\frac{du}{dx}dx$; in the case of u, a function of two independent variable quantities, there will be two fluxions connected with the function, one derived from the variable quantity x, which will be expressed by $\frac{du}{dx}dx$, and the other derived from y, which must in like manner be expressed by $\frac{du}{dy}dy$. These are called the *partial fluxions* of the function; and, in the language of the differential calculus, the *partial differentials*, also, by some, the *partial differences*. The sum of the partial fluxions, viz. $\frac{du}{dx}dx+\frac{du}{dy}dy$ is the whole fluxion of u considered as a function of x and y.

When u is a function of x only, instead of $\frac{du}{dx}dx$, it is usual to write simply du, because, when there is only one variable quantity, the symbol du can have but one meaning; but when there are two variable quantities, it is necessary to indicate what part of the whole fluxion results from each; which is conveniently done by writing the fluxional coefficients thus, $\left(\frac{du}{dx}\right)$, $\left(\frac{du}{dy}\right)$, as was done by Euler, or more simply thus, $\frac{du}{dx}, \frac{du}{dy}$, as is now the common practice.

104. As examples of functions of two independent variable quantities, 1. Let $u=x+y$, then $du=dx+dy$.

2. Let $u=xy$; then $\frac{du}{dx}=y$, and $\frac{du}{dx}dx=y\,dx$, also $\frac{du}{dy}=x$ and $\frac{du}{dy}dy=x\,dy$, therefore $du=y\,dx+x\,dy$.

3. Let $u=\frac{x}{y}$, then $\frac{du}{dx}=\frac{1}{y}$, $\frac{du}{dy}=-\frac{x}{y^2}$, $\frac{du}{dx}dx=\frac{dx}{y}$, $\frac{du}{dy}dy=-\frac{x\,dy}{y^2}$; hence, $du=\frac{dx}{y}-\frac{x\,dy}{y^2}=\frac{y\,dx-x\,dy}{y^2}$. In these examples, we have evidently got the same results as if x and y had been functions of some third quantity t, (Art. 29. and 30.) Indeed this ought to be the case, seeing that the fluxion of u cannot be affected by the circumstance of y being a function of x, unless the particular form of the function be assigned.

105. From the first fluxion of u, a function of the independent variable quantities x and y, we find its second fluxion thus; because $du=\frac{du}{dx}dx+\frac{du}{dy}dy$, therefore $d^2u=d\left(\frac{du}{dx}dx\right)+d\left(\frac{du}{dy}dy\right)$; but, employing still the same notation, $d\left(\frac{du}{dx}dx\right)=\frac{d^2u}{dx^2}dx^2+\frac{d^2u}{dy\,dx}dx\,dy$; and $d\left(\frac{du}{dy}dy\right)=\frac{d^2u}{dx\,dy}dy\,dx+\frac{d^2u}{dy^2}dy^2$, here dx and dy are considered as constant. Therefore, observing that $\frac{d^2u}{dx\,dy}=\frac{d^2u}{dy\,dx}$ (Art. 102.) we have

$$d^2u=\frac{d^2u}{dx^2}dx^2+2\frac{d^2u}{dx\,dy}dx\,dy+\frac{d^2u}{dy^2}dy^2.$$

Thus we see, that the second fluxion of the function u is composed of three partial fluxions of the second order. The third, and higher fluxions of u, may be found in the same manner.

106. From functions which contain two independent variable quantities, we might proceed to such as contain three. Supposing u to be a function of the three independent variable quantities x, y, z, it will have three partial fluxional coefficients, one relative to x, which may be expressed by the symbol $\frac{du}{dx}$; another relative to y, which will be $\frac{du}{dy}$; and a third relative to z, which will be $\frac{du}{dz}$. Thus there are three partial fluxions,

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whose sum $\frac{du}{dx}dx + \frac{du}{dy}dy + \frac{du}{dz}dz$, is the complete fluxion of u. Our limits, however, will not permit us to enter farther into this branch of the subject: besides, it is easy to extend what has been already shewn, to functions of any number of quantities.

Application of Infinitesimals to Fluxions.

107. The celebrated Leibnitz founded his theory of the differential calculus upon the doctrine of infinitely little quantities. To this method it has been objected, that the notion of infinitely small quantity is too vague to form the foundation of a mathematical theory, and on this account it has been laid aside by late writers, in establishing the principles of the calculus. It must be confessed, however, that this view of the subject gives readily all the rules for the calculus, and affords a great facility in its applications to geometry and mechanics, particularly in questions of an intricate nature. On this account it is valuable, and, besides, we can always verify the results by more rigorous methods.

108. Leibnitz supposed that variable quantities were augmented by infinitely small increments, which might be neglected in respect of finite quantities, but which admitted of being compared among themselves. He therefore assumed, that two magnitudes which only differed by an indefinitely small quantity, might be taken the one for the other. The infinitely small increment of x was denoted by the symbol dx, that of y by dy, and so on. And it followed immediately from his principle, that in the developements of the increments of a function, all the powers of dx and dy that were higher than the first might be neglected. Thus, to find the differential or fluxion of xy; having developed the product $(x+dx)(y+dy) = xy + xdy + ydx + dxdy$, and subtracted the primitive function xy, he rejected the term $dxdy$, as infinitely little in respect of the two others, and thus got $d(xy) = xdy + ydx$. In effect, since $1 : dx :: dy : dxdy$, if we regard dx as infinitely less than any finite quantity represented by 1, then $dxdy$ must be infinitely less than dy or dx. If $x = y$, then $d(x^2) = 2xdx$. By substituting now x^2 instead of y, and $2xdx$ instead of dy, in the formula $d(xy) = xdy + ydx$, we get $d(x^3) = 3x^2dx$, and in this way, the fluxion of x^n may be found.

With regard to fluxions of the higher orders, his theory required that fluxions, or differentials of the second order, should be considered as infinitely little in respect to those of the first order; and therefore as homogeneous with the squares of these last. Hence, to find the second and higher differentials, it was only necessary to consider the differentials as new variable quantities, which had themselves differentials of the next higher order, and to reject from the result all the terms which were of an order superior to that one.

109. Let x and y be the co-ordinates of a curve, and z an arc between the top of the ordinate and some determinate point in the curve. Suppose now x to be augmented by the infinitely little line dx; then, corresponding to this, y will be augmented by dy, and z by dz. As this last quantity is indefinitely little, it may be taken as a straight line, which, when produced, will be a tangent to the curve. The three indefinitely little lines, or differentials, dx, dy, dz, form the sides of a right-angled triangle, from which it is easy to deduce the tangent, and every thing relating to the curve. Thus, $\frac{dy}{dx}$ will manifestly be the trigonometrical tangent of the angle which a tangent to the curve makes with the axis, and consequently $\frac{dx}{dy}y$ will be the subtangent. Also, $y\,dx$ will be the infinitely little increment, or differential of the area; and, from the nature of a right-angled triangle, we have $\sqrt{(dx^2 + dy^2)} = dz$, which is the formula for the differential of the arc.

110. Although Leibnitz's view of the subject led to correct results, he did not seize the true spirit of his method. He ought to have given a better reason for rejecting certain quantities, than that of their being indefinitely small, when compared with others which he retained. The truth was, they ought to have been rejected, in order to make the results correct. On this subject, a small tract by Carnot, entitled, *Reflexions sur la Metaphysique du Calcul Infinitesimal*, may be consulted.

SECTION III.

OF THE INVERSE METHOD OF FLUXIONS.

Inverse method of fluxions.

111. THE Inverse Method of Fluxions, called also the *Integral Calculus*, treats in general of the manner of finding the fluent of any proposed fluxion; or it teaches how to find fluents, whose fluxions shall have to each other any assigned relation. The general problem to be resolved, is far more difficult than in the direct method. In this last, it is always possible to find the relation of the fluxions, when that of the variable quantities themselves is known; but to determine on the contrary, the relation of the variable quantities from that of their fluxions, is, in many cases, a problem that requires the utmost resources of analysis to give even an approximation to the solution. This arises from the nature of the problem not admitting of general rules. All that can be done, is to compare any proposed fluxion with such fluxions as are derived from known fluents, by the direct method; and if they have the same form, we may conclude that the fluents, or at least their variable parts, are functions of the same form.

As in the direct method, all quantities are reduced, by proper transformations, to a certain number of elementary functions; so in the inverse method, we must endeavour to transform complex fluxional expressions into others more simple, so as to reduce them, if possible, to some fluxion, whose fluent is known.

112. We have employed the letter d as a symbol to indicate the fluxion of any fluent. To denote the fluent of any fluxion, we shall now employ the character $\int$, the initial letter of the word *sum*, which has been adopted generally by foreign, and partially by British mathematicians. Accordingly, by $\int a\,x^n\,dx$, the fluent of the expression $a\,x^n\,dx$ is meant. What we have called a fluent, is sometimes denominated by British mathematicians, and always by foreigners, the *Integral*; and to *integrate a fluxion*, or differential, has the same meaning as *to find its fluent*. The process by which the integral is found, is called *Integration*.

Fundamental Rules.

113. We have found (Art. 27. and 28.) that in a function consisting of several terms, such as are con-

stant always disappear in taking its fluxion; so that u being supposed variable, and c constant, the fluxions of u and $u+c$, are the same expression du. *Therefore, on the contrary, the general expression for the fluent of* d u *will be* u + c, *in which* c *denotes an arbitrary constant quantity, which can only be determined by the particular nature of the inquiry in which the fluxion occurs.* This constant quantity is commonly called by writers on Fluxions, the *Correction* of the fluent.

114. By reversing the principal rules of the direct method, we find as many for the inverse method.

I. *The fluent of a fluxion consisting of several terms, is the sum of the fluents of its terms, each retaining its sign, and coefficient* (art. 27.) Thus, if $dy = a\,dv - b\,du$, then $y = av - bu + c$, putting c for the constant quantity, or correction of the fluent.

II. As the fluxion of $x^n + c$ is $n x^{n-1}\,dx$; (Rule (A) Art. 26.) on the contrary, the fluent of $n x^{n-1}\,dx$ will be $x^n + c$; that is, *we must increase the exponent by unity, and reject the factor* d x, *and divide by the exponent thus increased.* Hence also,

$$\int A x^n\,dx = \frac{A x^{n+1}}{n+1} + c.$$

As particular examples,

$$\int \frac{a\,dx}{x^3} = \int a x^{-3}\,dx = -\tfrac{1}{2} a x^{-2} + c = -\frac{a}{2x^2} + c.$$

Also, $$\int \frac{dz}{\sqrt{z}} = 2\sqrt{z} + c.$$

This rule applies to all fluxions which can be reduced to the form $x^n\,dx$. For example, let the fluxion be $a x^{n-1}\,dx\,(b + e x^n)^m$: as the fluxion of $b + e x^n$ is $n e x^{n-1}\,dx$, we may bring the first factor $a x^{n-1}\,dx$ to this form, since it only differs in the constant factor ne. Accordingly, putting $z = b + e x^n$, we have

$$\frac{a}{ne} \times n e x^{n-1} dx\,(b + e x^n)^m = \frac{a}{ne} z^m dz;$$

Therefore the fluent is

$$\frac{a z^{m+1}}{ne(m+1)}, \text{ or } \frac{a}{ne(m+1)}(b + e x^n)^{m+1} + c.$$

The transformation which has introduced z is not absolutely necessary, and, in such a case, may with advantage be avoided. In like manner,

$$\int 6\sqrt{(4x^2+3)}\,x\,dx = \tfrac{1}{2}(4x^2+3)^{\frac{3}{2}} + c.$$

III. The foregoing rule fails when $n = -1$, because then $\int z^{-1}\,dz = \frac{z^0}{0} + c$, an expression of which the first term is infinite; but this happens because the fluxion belongs to another kind of function. It appears from Art. 26, Rule (B), that $\int \frac{dz}{z} = \text{l}(z) + c$, and more generally that

$$\int \frac{dz}{a+z} = \text{l}(a+z) + c.$$

Therefore, *if a fluxion be a fraction of which the numerator is the fluxion of the denominator, the fluent will be the Napierean logarithm of the denominator.* In this case, it is convenient to put the constant quantity added to the fluent under the form l. (c).

The fluxion $\frac{5x^3 dx}{3x^4+7}$ is immediately reduced to this rule by a proper adaptation of its constant factor: thus,

$$\int \frac{5}{12}\,\frac{12 x^3 dx}{3x^4+7} = \frac{5}{12}\left\{\text{l}(3x^4+7) + \text{l}(c)\right\}$$
$$= \frac{5}{12}\,\text{l}\left\{c(3x^4+7)\right\}$$

IV. We have found, (Art. 29.) that u and t being any functions of a variable quantity, $d(ut) = u\,dt + t\,du$, therefore,

$$ut = \int u\,dt + \int t\,du$$
$$\text{and} \int u\,dt = ut - \int t\,du.$$

This manner of expressing a fluent is of great importance: writers on the differential calculus call it *the method of integrating by parts.* As an example, let the fluxion be l. $(x)\,dx$; then, putting $dt = dx$, and $u = \text{l}.(x)$, so that $du = \frac{dx}{x}$, we have

$$\int \text{l}.(x)\,dx = x\,\text{l}.(x) - x + c.$$

The rule indicated by the formula has the advantage of making the fluent depend upon another, which, by analytical address, may frequently be more easily obtained.

V. From rule (D), art. 26, if the radius of a circle be unity, we have

$$\int \frac{dz}{\sqrt{(1-z^2)}} = \text{arc. (sin.} = z) + c,$$
$$\int \frac{-dz}{\sqrt{(1-z^2)}} = \text{arc. (cos.} = z) + c.$$

By these expressions are meant the arc, of which the sine and cosine are z. Again, from art. 35,

$$\int \frac{dz}{1+z^2} = \text{arc (tan.} = z) + c.$$

We may also suppose the radius $= r$, and we shall have

$$\int \frac{r\,dz}{\sqrt{(r^2-z^2)}} = \text{arc (sin.} = z) + c.$$

To find the fluent of $\frac{m\,dz}{a+bz^2}$, we put it under this form,

$$\frac{m}{a}\,\frac{dz}{1+\frac{bz^2}{a}} = \frac{m}{a}\sqrt{\frac{a}{b}}\cdot\frac{dt}{1+t^2},$$

by making $\frac{bz^2}{a} = t^2$. Therefore, $\frac{m}{\sqrt{(ab)}}$ arc (tan. $= t$) is the fluent sought, supposing the radius unity, and hence

$$\int \frac{m\,dz}{a+bz^2} = \frac{m}{\sqrt{(ab)}}\cdot\text{arc}\left(\text{tan.} = z\sqrt{\frac{b}{a}}\right) + c.$$

In like manner we find,

$$\int \frac{m\,dz}{\sqrt{(a^2-bz^2)}} = \frac{m}{\sqrt{b}}\cdot\text{arc (sin.} = \frac{z}{a}\sqrt{b}) + c.$$

The direct method furnishes other rules, which will be noticed in the sequel.

Decomposition of Rational Fractions.

115. Let it be proposed to resolve the fraction $\frac{kx+l}{(x-a)(x-b)}$ into two others, of which it shall be the sum. With a little attention it will appear, that the fractions sought may have the form $\frac{A}{x-a}$ and $\frac{B}{x-b}$, A and B being indeterminate coefficients, which are in-

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dependent of x. By reducing them to a common denominator, and adding, their sum is $\frac{(A+B)x-(bA+aB)}{(x-a)(x-b)}$, which, compared with the proposed fraction, gives $A+B=k$, $bA+aB=-l$, from these equations we get

$$A=-\frac{ka+l}{b-a},\ B=\frac{kb+l}{b-a}.$$

Hence the practicability of the resolution, and the manner of performing it, are shewn.

Next, let the fraction $\frac{kx^2+lx+m}{(x-a)^2(x-b)}$ be proposed. We may suppose it $=\frac{Ax+B}{(x-a)^2}+\frac{C}{x-b}$. By reducing to a common denominator, we find $kx^2+lx+m=(A+C)x^2+(B-Ab-2aC)x+(a^2C-Bb)$.

Hence, by the theory of indeterminate coefficients, $k=A+C$, $l=B-Ab-2aC$, $m=a^2C-Bb$. By these equations, which are all of the first degree, A, B, and C may be determined. Exactly in the same manner it will be found, that the fraction

$$\frac{kx^3+lx^2+mx+n}{(x-a)^3(x-b)}$$

may be decomposed, so as to be equivalent to

$$\frac{Ax^2+Bx+C}{(x-a)^3}+\frac{D}{x-b}.$$

In general, let $\frac{U}{V}$ be an irreducible fraction, such, that the highest power of x in the numerator is one less than its highest power in the denominator, and let $V=P\times Q$, P and Q being polynomials which have no common factor, and in which the exponents of the highest powers of x are p and q. We may assume $\frac{U}{V}=$

$$\frac{Ax^{p-1}+Bx^{p-2}\ldots+L}{P}+\frac{A'x^{q-1}+\ldots+L'}{Q}$$

When these fractions are reduced to a common denominator, the new numerators will be polynomials of a degree of which the exponent is $p+q-1$, the same as that of U, the numerator of the proposed fraction: therefore, by assuming that the sum of these polynomials is equal to U, and putting the coefficients of like powers of x equal to one another, there will result $p+q$ equations, by which such values will be found for the indeterminate quantities A, B, ... L and A′, ... L′ (which are $p+q$ in number) as will make the two expressions identical.

If P and Q are themselves the product of two factors prime to each other, the new fractions may be decomposed in all respects like the original fraction, and so on: and proceeding in this way, *the proposed fraction may be decomposed into as many others as there are unequal factors in its denominator, the partial numerators being complete polynomials of a degree less by one than that of their denominators.*

116. Whatever be the degree of the numerator of the rational fraction $\frac{U}{V}$, by division it may be brought to a lower degree than its denominator. The decomposition of the fraction thus prepared, presents four cases.

Case I. If the denominator V has real and unequal factors, or if $V=(x-a)(x-b)\ldots\times S$, we may suppose

$$\frac{U}{V}=\frac{A}{x-a}+\frac{B}{x-b}\ldots+\frac{P}{S}.$$

Example 1. Let the fraction be $\frac{2-4x}{x^2-x-2}$. By the theory of equations, (Algebra,) if a, b be the roots of the equation $x^2-x-2=0$, then $x^2-x-2=(x-a)(x-b)$. The equation gives $x=+2$ and $x=-1$; therefore $x^2-x-2=(x-2)(x+1)$ so that we must assume

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$$\frac{2-4x}{x^2-x-2}=\frac{A}{x-2}+\frac{B}{x+1}.$$

Hence we find $A=-2=B$, and the proposed fraction $=\frac{2}{2-x}-\frac{2}{x+1}$.

Ex. 2. In like manner for the fraction $\frac{1}{a^2-x^2}=\frac{A}{a+x}+\frac{B}{a-x}$, by reducing to a common denominator, and putting the numerators equal to one another, we find $1=(B-A)x+a(B+A)$; here we must make $B-A=0$, and $a(B+A)=1$, which gives $B=A=\frac{1}{2a}$, and

$$\frac{1}{a^2-x^2}=\frac{1}{2a(a+x)}+\frac{1}{2a(a-x)}.$$

Ex. 3. Assuming $\frac{1}{x(a^2-x^2)}=\frac{A}{x}+\frac{B}{a+x}+\frac{C}{a-x}$, we have $1=Aa^2+ax(B+C)+x^2(C-A-B)$ which gives $1=Aa^2$, $B+C=0$, $C-A-B=0$; hence $A=\frac{1}{a^2}$, $B=-\frac{1}{2a^2}$, $C=\frac{1}{2a^2}$, thus $\frac{1}{x(a^2-x^2)}=\frac{1}{a^2x}-\frac{1}{2a^2(a+x)}+\frac{1}{2a^2(a-x)}$.

Case II. When the denominator V has unequal and imaginary factors of the first degree, which, when multiplied two and two, produce real factors of the second, so that

$$V=(x^2+px+q)(x^2+p'x+q')\ldots\times S,$$

we may suppose

$$\frac{U}{V}=\frac{Ax+B}{x^2+px+q}+\frac{Cx+D}{x^2+p'x+q'}\ldots+\frac{P}{S}.$$

Ex. 4. Suppose $\frac{x^2-x+1}{(1+x)(1+x^2)}=\frac{A}{1+x}+\frac{Bx+C}{1+x^2}$. In this example, $A=\frac{3}{2}$, $B=C=-\frac{1}{2}$.

Ex. 5. In like manner, assuming that $\frac{x}{x^3-1}=\frac{A}{x-1}+\frac{Bx+C}{x^2+x+1}$, we find $A=C=-B=\frac{1}{3}$.

Case III. If V has real and equal factors, so that $V=(x-a)^n S$, we may assume

$$\frac{U}{V}=\frac{Ax^{n-1}+Bx^{n-2}\ldots}{(x-a)^n}+\frac{P}{S},$$

but it is better to put

$$\frac{U}{V}=\frac{A}{(x-a)^n}+\frac{B}{(x-a)^{n-1}}+\ldots\frac{T}{x-a}+\frac{P}{S}$$

By reducing to a common denominator, the two assumptions are evidently the same.

Ex. 6. Thus for the fraction $\frac{x^3+x^2+2}{x(x-1)^2(x+1)^2}$, although it may be decomposed into $\frac{A}{x}+\frac{Bx+C}{(x-1)^2}+$

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$\frac{Dx+E}{(x+1)^2}$, which gives $A=2$, $B=-\frac{3}{4}$, $C=-E=\frac{7}{4}$, $D=-\frac{5}{4}$, it will be better to make the fraction $=$

$$\frac{A}{x}+\frac{B}{(x+1)^2}+\frac{C}{x+1}+\frac{D}{(x-1)^2}+\frac{E}{x-1},$$

This expression, by substituting the values of A, B, C, &c. becomes

$$\frac{2}{x}-\frac{1}{2}\frac{1}{(x+1)^2}-\frac{5}{4}\frac{1}{x+1}+\frac{1}{(x-1)^2}-\frac{3}{4}\frac{1}{x-1}.$$

Ex. 7. In like manner, $\frac{1}{x(1+x)^2(1+x+x^2)}$ is equivalent to $\frac{1}{x}-\frac{2x+3}{(1+x)^2}+\frac{x}{1+x+x^2}$, also to

$$\frac{1}{x}-\frac{1}{(x+1)^2}-\frac{2}{x+1}+\frac{x}{1+x+x^2}$$

Case IV. Supposing the factors of the trinomial x^2+px+q to be imaginary, if V has for a factor $(x^2+px+q)^n$, we may make

$$\frac{U}{V}=\frac{Ax^{2n-1}+Bx^{2n-2}+\ldots+T}{(x^2+px+q)^n}+\frac{P}{S},$$

or rather,

$$\frac{U}{V}=\frac{Ax+B}{(x^2+px+q)^n}+\frac{Cx+D}{(x^2+px+q)^{n-1}}+\ldots$$

Ex. 8. Thus, we make $\frac{1}{(1+x)x^2(x^2+2)(x^2+1)^2}=$

$$\frac{A}{1+x}+\frac{B}{x^2}+\frac{C}{x}+\frac{Dx+E}{x^2+2}+\frac{Fx+G}{(x^2+1)^2}+\frac{Hx+I}{x^2+1},$$

and find $A=\frac{1}{12}$, $B=-C=\frac{1}{2}$, $D=-E=\frac{1}{6}$, $F=-G=\frac{1}{2}$, $H=-I=\frac{1}{4}$.

117. The manner of determining the quantities A, B, C, &c. as expressed in last article, is that suggested by the theory of indeterminate coefficients, (Algebra, art. 313.) but it is very tedious. We shall now shew how the labour may be greatly abridged.

(1.) Let $\frac{U}{V}=\frac{A}{x-a}+\frac{P}{S}$ be an identical equation, and $V=S(x-a)$, supposing also that $x-a$ is not a factor of S, we propose to find A independently of P.

Reducing to a common denominator, we get

$$U=AS+P(x-a).$$

As this must hold true for every value of x, let $x=a$, and let us suppose, that upon this hypothesis U and S become u and s respectively, then

$$u=As, \text{ and } A=\frac{u}{s}.$$

Thus, in the case of the fraction $\frac{1}{a^2-x^2}=\frac{A}{a-x}+\frac{B}{a+x}$, we have $1=A(a+x)+B(a-x)$. When $x=a$, this equation becomes $1=2Aa$; and when $x=-a$, it becomes $1=2Ba$; hence $A=B=\frac{1}{2a}$.

Taking the fluxions of the identical equation $V=S(x-a)$, considering that V and S are functions of x, we find $\frac{dV}{dx}=\frac{dS}{dx}(x-a)+S$; supposing now $x=a$, then, putting v' for the value of $\frac{dV}{dx}$ when a is substituted in it instead of x, we have $v'=s$; therefore also $A=\frac{u}{v'}$.

In the fraction $\frac{1}{a^2-x^2}$, $U=1$, $V=a^2-x^2$; therefore $\frac{dV}{dx}=-2x$; when $x=a$, U becomes $u=1$, and $\frac{dV}{dx}$ becomes $v'=-2a$, therefore, one of the partial fractions is $-\frac{1}{2a(x-a)}=\frac{1}{2a(a-x)}$. The other is found by making $x=-a$.

(2.) Next, let us consider the case in which $\frac{U}{V}=$

$$\frac{A}{(x-a)^n}+\frac{B}{(x-a)^{n-1}}\ldots+\frac{T}{x-a}+\frac{P}{S}.$$

Let both members of the equation be multiplied by $(x-a)^n$, then, observing that $V=(x-a)^n S$, and putting K for $\frac{U}{S}$, we have

$$K=A+B(x-a)+C(x-a)^2+\ldots$$

Now, make $x=a$, and put u and s to denote as before, and have $A=K=\frac{u}{s}$; and since

$$K-A=B(x-a)+C(x-a)^2+\ldots$$

the first member $K-A$ must be divisible by $x-a$; it will therefore have the form $K_{,}(x-a)$; hence,

$$K_{,}=B+C(x-a)+\ldots$$

Suppose now $x=a$, and that then $K_{,}$ becomes $k_{,}$, thus we have $B=k_{,}$, and so on.

Or we may employ the fluxional calculus; for since

$$K=A+B(x-a)+C(x-a)^2+\ldots$$

by taking the fluxions,

$$\frac{dK}{dx}=B+2C(x-a)+3D(x-a)^2+\ldots$$

$$\frac{d^2K}{dx^2}=2C+6D(x-a)+\ldots$$

Put k, k' k'', &c. for the values of K, $\frac{dK}{dx}$, $\frac{d^2K}{dx^2}$, &c. respectively, in the particular case of $x=a$; then, making that hypothesis, we find

$$A=k,\ B=k',\ C=\tfrac{1}{2}k'',\ D=\tfrac{1}{6}k''', \text{ \&c.}$$

Resuming example 6, of art. 116, we assume

$$\frac{x^3+x^2+2}{x^5-2x^3+x}=\frac{A}{(x+1)^2}+\frac{B}{x+1}+\frac{P}{S};$$

Hence, $\frac{x^3+x^2+2}{x(x-1)^2}=A+B(x+1)+\frac{P}{S}(x+1)^2$,

$$\frac{3x^2+2x-A(3x^2-4x+1)}{x(x-1)^2}=B+\text{\&c.}$$

Making now $x=-1$, we find $A=-\frac{1}{2}$, $B=-\frac{5}{4}$.

(3.) Let the equation be

$$\frac{U}{V}=\frac{Ax+B}{x^2+px+q}+\frac{P}{S},$$

then $U=(Ax+B)S+P(x^2+px+q)$.

If we substitute for x, one of the imaginary roots of the equation $x^2+px+q=0$, P will disappear, and the result will contain two kinds of terms, one real, and the other imaginary. We must now put the real quantities on each side of the equation equal to one another, and also the imaginary quantities; thus two equations will be obtained, by which A and B may be determined.* Let the fraction be

$$\frac{x}{(x-1)(x^2+x+1)}=\frac{Ax+B}{x^2+x+1}+\frac{P}{S},$$

hence $x=(Ax+B)(x-1)+P(x^2+x+1)$.
Now $x^2+x+1=0$ gives $x=-\frac{1}{2}\pm\frac{1}{2}\sqrt{-3}$, therefore, by substituting in this last equation, it becomes

$$-\tfrac{1}{2}\pm\tfrac{1}{2}\sqrt{-3}=-\tfrac{1}{2}A\pm\tfrac{1}{2}A\sqrt{-3}+B)(-\tfrac{3}{2}\pm\tfrac{1}{2}\sqrt{-3})=\mp A\sqrt{-3}\pm\tfrac{1}{2}B\sqrt{-3}-\tfrac{3}{2}B.$$

Hence, putting the real and the imaginary parts separately equal, and dividing the latter by $\pm\sqrt{-3}$, we find

$$-\tfrac{1}{2}=-\tfrac{3}{2}B,\ \tfrac{1}{2}=-A+\tfrac{1}{2}B;$$

therefore $-A=B=\frac{1}{3}$.

(4.) Let us consider the fraction, when $\frac{U}{V}=$

$$\frac{Ax+B}{(x^2+px+q)^n}+\frac{A'x+B'}{(x^2+p'x+q')^{n-1}}\ldots+\frac{P}{S}.$$

Let both sides of the equation be multiplied by $(x^2+px+q)^n$, and observing that $V=(x^2+px+q)^n S$, let $K=\frac{U}{S}$, and we have

$$K=Ax+B+(A'x+B')(x^2+px+q)+\ \&c.$$

This case is compounded of the two preceding, and must be treated in the same manner. In the first place, we substitute for x one of the roots of the equation $x^2+px+q=0$, by which the equation is reduced to $K=Ax+B$. The real and imaginary quantities are now to be made separately equal, as in last case; and hence two equations are got, by which A and B are determined.

By taking the fluxions of both sides of the equation, we find

$$\frac{dK}{dx}=A+(A'x+B')(2x+p);$$

here we omit all the terms in which x^2+px+q is a factor. By substituting, in this expression, the imaginary value of x in the equation $x^2+px+q=0$, and putting the real and imaginary terms on each side equal, two equations are found, by which A′ and B′ are determined.

For example, let the fraction be $\frac{x^3-2x^2+x-3}{(x^2-2x+2)^2}$, we assume it

$$=\frac{Ax+B}{(x^2-2x+2)^2}+\frac{A'x+B'}{x^2-2x+2}.$$

By reducing to a common denominator, we find

$$x^3-2x^2+x-3=$$
$$Ax+B+(A'x+B')(x^2-2x+2).$$

One of the roots of the equation $x^2-2x+2=0$ is $x=1+\sqrt{-1}$. This being substituted for x, the equation becomes

$$-4-\sqrt{-1}=A+B+A\sqrt{-1}.$$

Hence the two equations are $A+B=-4$, and $A=-1$, therefore $B=-3$. Substituting the values of A and B in the equation, and transposing, we have

$$x^3-2x^2+2x=(A'x+B')(x^2-2x+2);$$

and taking the fluxions, and dividing by dx,

$$3x^2-4x+2=(A'x+B')(2x-2)+\ \&c.$$

By again substituting $1+\sqrt{-1}$ for x, this equation becomes $-2+2\sqrt{-1}=-2A'+2(A'+B')\sqrt{-1}$; hence $A'=1$, $B'=0$; therefore the proposed fraction is equivalent to

$$-\frac{x+3}{(x^2-2x+2)^2}+\frac{x}{x^2-2x+2}.$$

118. The decomposition of the rational fraction $\frac{U}{V}$ into partial fractions, requires that the denominator $V=Ax^n+Bx^{n-1}+Cx^{n-2}\ldots+L$ be resolved into its real factors of the first or of the second degree, which can only be effected by the resolution of an equation of the *n*th order. This problem, however, cannot be completely resolved, except in the lower degrees, and particular cases of the higher, in the present state of analysis. When the function V has the form $x^{2n}+2ax^n+1$, (a being less than unity,) or when it can be reduced to that form, it may be elegantly resolved into its factors by the trigonometrical tables, as explained in ARITHMETIC *of Sines*, art. 23, 25. This case comprehends also $x^n\pm1$. On the general resolution of equations, consult Lagrange *De la Resolution des Equations Numeriques*. On the decomposition of rational fractions, see Euler *Inst. Cal. Differentialis Pars. Post.* cap. xi.

Fluents of Rational Fractions.

119. We have seen, that every rational fraction may be reduced to partial fractions, which have these forms,

$$\frac{A}{x-a},\qquad\frac{A}{(x-a)^n}$$
$$\frac{Ax+B}{x^2+px+q},\qquad\frac{Ax+B}{(x^2+px+q)^n},$$

A, B, p, q, n, being constant quantities, and the factors of x^2+px+q imaginary quantities. If we make $x=z-\frac{1}{2}p$, and put $\beta^2=q-\frac{1}{4}p^2$, the two last fractions are transformed to

$$\frac{Az+B'}{z^2+\beta^2},\ \frac{Az+B'}{(z+\beta^2)^n}.$$

Hence the fluents of rational fractions may be comprehended in four cases.

CASE I. The fluent of $\frac{A\,dx}{x-a}$ is $A\times l.(x-a)+l.(c)$, (Art. 114, Rule III.) But l. (c) being a quantity altogether arbitrary, we may put instead of it $A\times l.(c')$, and then the fluent is also $A\times l.\left\{c'(x-a)\right\}$.

And since $\frac{dx}{a^2-x^2}=\frac{1}{2a}\left\{\frac{dx}{a+x}+\frac{dx}{a-x}\right\}$, (art. 116. Example 2.) therefore the fluent of $\frac{dx}{a^2-x^2}$ is

$$\frac{1}{2a}\left\{l.(a+x)-l.(a-x)+l.(c)\right\},$$
$$\text{or}\int\frac{dx}{a^2-x^2}=\frac{1}{2a}\,l.\frac{c(a+x)}{a-x}.$$

In like manner, $\frac{(2-4x)dx}{x^2-x-2}=\frac{2dx}{2-x}-\frac{2dx}{x+1}$ has for its fluent $-2\,l.(x-2)-2\,l.(x+1)+l.(c)$, or $l.\frac{c}{(x^2-x-2)^2}$.

CASE II. The fraction $\frac{A\,dx}{(x-a)^n}$ has for its fluent

$$\frac{-A}{(n-1)(x-a)^{n-1}}\ \text{(art. 114. Rule II.)}$$

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* For the management of impossible or imaginary quantities, see ALGEBRA, Art. 190—194.

We have found (art. 116, Ex. 6.) that $\frac{x^3+x^2+2}{x^5-2x^3+x}dx$

$$=\frac{2dx}{x}+\frac{dx}{(x-1)^2}-\tfrac{3}{4}\frac{dx}{x-1}-\tfrac{1}{2}\frac{dx}{(x+1)^2}-\tfrac{5}{4}\frac{dx}{x+1}$$

Therefore, the fluent of the fraction is

$$2\,\mathrm{l.}\,(x)-\frac{1}{x-1}-\tfrac{3}{4}\,\mathrm{l.}\,(x-1)+\frac{1}{2(x+1)}$$
$$-\tfrac{5}{4}\,\mathrm{l.}\,(x+1)+c.$$

Case III. The fraction $\frac{Az+B}{z^2+\beta^2}dz$ may be resolved into $\frac{Az\,dz}{z^2+\beta^2}$ and $\frac{B\,dz}{z^2+\beta^2}$. The fluent of the first of these is $\frac{1}{2}A\,\mathrm{l.}\,(z^2+\beta^2)+c$, (art. 114. Rule III.) and the fluent of the second is $\frac{B}{\beta}\,\mathrm{arc}\left(\tan.=\frac{z}{\beta}\right)+c$ (114, Rule V,) therefore, uniting the corrections of the two parts into one,

$$\int\frac{(Az+B)\,dz}{z^2+\beta^2}=\tfrac{1}{2}A\,\mathrm{l.}(z^2+\beta^2)+\frac{B}{\beta}\,\mathrm{arc}\left(\tan.=\frac{z}{\beta}\right)+c.$$

We have found (art. 116. Ex. 5.) that

$$\frac{x\,dx}{x^3-1}=\tfrac{1}{3}\frac{dx}{x-1}-\tfrac{1}{3}\frac{(x-1)\,dx}{x^2+x+1}.$$

The fluent of the first term of the second member is $\frac{1}{3}\,\mathrm{l.}\,(x-1)$ (art. 114. Rule III.) Make $x=z-\frac{1}{2}$ by which $dx=dz$, then the second term is transformed to

$$-\tfrac{1}{3}\frac{z\,dz}{z^2+\frac{3}{4}}+\tfrac{1}{2}\frac{dz}{z^2+\frac{3}{4}}.$$

Now the fluent of the first of these is $-\frac{1}{6}\,\mathrm{l.}\,(z^2+\frac{3}{4})$; (art. 114. Rule III.) and the fluent of the other is $\frac{1}{3}\sqrt{3}\,\mathrm{arc}\left(\tan.=\frac{2z}{\sqrt{3}}\right)$: therefore, restoring x in these expressions, we find

$$\int\frac{x\,dx}{x^3-1}=\tfrac{1}{3}\left\{\mathrm{l.}\,(x-1)-\mathrm{l.}\,\sqrt{(x^2+x+1)}\right\}$$
$$+\tfrac{1}{3}\sqrt{3}\,\mathrm{arc}\left(\tan.=\frac{2x+1}{\sqrt{3}}\right)+c.$$

By bringing the logarithmic functions into one term, and supposing the arbitrary correction to be $\frac{1}{3}\,\mathrm{l.}\,(c')$, the fluent may also be expressed thus

$$\mathrm{l.}\left\{\frac{c'(x-1)}{\sqrt{(x^2+x+1)}}\right\}^{\frac{1}{3}}+\frac{\sqrt{3}}{3}\,\mathrm{arc}\left(\tan.=\frac{2x+1}{\sqrt{3}}\right)$$

As a second example, let the fluxion be $\frac{(x^2-x+1)dx}{(x+1)(x^2+1)}$. This (art. 116, Ex. 4.) may be decomposed into $\frac{3}{2}\frac{dx}{x+1}-\frac{1}{2}\frac{(x+1)\,dx}{x^2+1}$; the latter of these again may be expressed thus $-\frac{1}{2}\frac{x\,dx}{x^2+1}-\frac{1}{2}\frac{dx}{x^2+1}$. The fluents of these partial fractions being found as before, the fluent of the proposed fluxion is

$$\mathrm{l.}\,\frac{c\sqrt{(x+1)^3}}{\sqrt[4]{(x^2+1)}}-\tfrac{1}{2}\,\mathrm{arc}\,(\tan.=x)$$

Case IV. Let us now consider the fraction $\frac{(Az+B)\,dz}{(z^2+\beta^2)^n}$. First we divide it into two, $\frac{Az\,dz}{(z^2+\beta^2)^n}$ and $\frac{B\,dz}{(z^2+\beta^2)^n}$. The fluent of the first of these is $\frac{-A}{2(n-1)(z^2+\beta^2)^{n-1}}$; (art. 114. Rule II.) But if $n=1$, then it is $\frac{1}{2}A\,\mathrm{l.}\,(z^2+\beta^2)$.

120. To find the fluent of $\frac{B\,dz}{(z^2+\beta^2)^n}$, let K and L be constant, but indeterminate co-efficients, and let us assume

$$\int\frac{dz}{(z^2+\beta^2)^n}=\frac{Kz}{(z^2+\beta^2)^{n-1}}+\int\frac{L\,dz}{(z^2+\beta^2)^{n-1}}.$$

Let the fluxions be now taken, which, in respect to quantities affected by the sign $\int$, is done by merely rejecting the sign, and we have

$$\frac{dz}{(z^2+\beta^2)^n}=\frac{K\,dz}{(z^2+\beta^2)^{n-1}}-\frac{2K(n-1)z^2\,dz}{(z^2+\beta^2)^n}$$
$$+\frac{L\,dz}{(z^2+\beta^2)^{n-1}}.$$

By reducing these fractions to a common denominator, and rejecting such quantities as are found in all the terms, we get $1=K(z^2+\beta^2)-2K(n-1)z^2+L(z^2+\beta^2)$, or

$$\left\{(2n-3)K-L\right\}z^2+1-\beta^2(K+L)=0;$$

Hence, by the theory of indeterminate co-efficients, $(2n-3)K-L=0$, $1-\beta^2(K+L)=0$. From these equations we find $K=\frac{1}{2(n-1)\beta^2}$, $L=\frac{2n-3}{2(n-1)\beta^2}$. Therefore, substituting for K and L, we find

$$\int\frac{dz}{(z^2+\beta^2)^n}=\frac{z}{2(n-1)\beta^2(z^2+\beta^2)^{n-1}}$$
$$+\frac{2n-3}{2(n-1)\beta^2}\int\frac{dz}{(z^2+\beta^2)^{n-1}}.$$

It is easy to see the use of this formula; by means of it the fluent $\int\frac{dz}{(z^2+\beta^2)^n}$ is made to depend upon another $\int\frac{dz}{(z^2+\beta^2)^{n-1}}$, in which n is diminished by an unit. This last, again, is reducible to another, in which the exponent is $n-2$, and so on, until we come to the fluent of $\frac{dz}{z+\beta^2}$; which is known by Rule V. art. 114.

The fraction $\frac{(x^4+2x^3+3x^2+3)\,dx}{(x^2+1)^3}$ will serve to exemplify this formula; when decomposed it becomes

$$\frac{(-2x+1)\,dx}{(x^2+1)^3}+\frac{(2x+1)\,dx}{(x^2+1)^2}+\frac{dx}{x^2+1}.$$

The first terms of each of the two first fractions give

$$\int\frac{-2x\,dx}{(x^2+1)^3}=\frac{1}{2(x^2+1)^2},\ \int\frac{2x\,dx}{(x^2+1)^2}=\frac{-1}{x^2+1}.$$

With respect to the other terms, by our formula

$$\int\frac{dx}{(x^2+1)^3}=\frac{x}{4(x^2+1)^2}+\tfrac{3}{4}\int\frac{dx}{(x^2+1)^2},$$

this last term, joined to the term $\int\frac{dx}{(x^2+1^2}$ of our second fraction, gives $\frac{7}{4}\int\frac{dx}{(x^2+1)^2}$; we have in like manner

$$\tfrac{7}{4}\int\frac{dx}{(x^2+1)^2}=\frac{7x}{8(x^2+1)}+\tfrac{7}{8}\int\frac{dx}{x^2+1}.$$

Lastly, joining this term to the third fraction, we find

$$\tfrac{15}{8}\int\frac{dx}{x^2+1}=\tfrac{15}{8}\,\mathrm{arc}\,(\tan.=x).$$

The different parts united give

$$\frac{2+x}{4(x^2+1)^2}+\frac{7x-8}{8(x^2+1)}+\tfrac{15}{8}\,\mathrm{arc}\,(\tan.=x)+c$$

for the complete fluent.

Inverse Method.

121. It appears that the fluent of every rational fraction is either an algebraic quantity, or else expressible in finite terms, by circular arcs and logarithms, so that granting the possibility of resolving a rational function into its factors, this branch of the calculus is perfect.

Leibnitz shewed first how to find the fluents of rational fractions in the *Acta Eruditorum*, 1702 and 1703. But he did not fully comprehend the theory; for he made it a question whether it was possible to express the fluent of $\frac{dx}{a^4+x^4}$ by the circle and logarithms. John Bernoulli followed in the same path as Leibnitz, but their methods were very laborious: The theory was, however, completed, by the discovery of Cotes, which we have already noticed, (art. 118.)

On this branch of the subject, see John Bernoulli, *Opera*; Cotes, *Harmonia Mensurarum*; De Moivre, *Miscellanea Analytica*; Simpson, *Essays on several subjects*, and *Fluxions*, Vol. II.; Landen, *Mathematical Lucubrations*, Part VII. Euler, *Inst. Cal. Diff. et Integralis.*

Of the Fluents of Irrational Functions.

122. We have shewn how the fluent of every rational algebraic function may be found; the same method will apply to all such irrational functions as can be rendered rational by transformation. Let us consider, in the first place, fluxions, in which the terms are singly radicals, such as

$$\frac{\sqrt[3]{x}+x\sqrt{x}+x^2}{x+\sqrt{x}}dx,$$

it is easy to see that by making $x=z^6$, the irrationality disappears, and as $dx=6z^5dz$, the fluxion is transformed to

$$\frac{6(z^{14}+z^{11}+z^4)dz}{z^3+1}=6z^{11}dz+6zdz-\frac{6zdz}{z^3+1},$$

which presents no difficulty.

Let the fluxion be $\frac{\sqrt{x}}{x-1}dx$; put $x=z^2$, then $dx=2zdz$, and the fluxion is transformed to

$$\frac{2z^2dz}{z^2-1}=2dz+\frac{2dz}{z^2-1},$$

of which the fluent is $2z+\log.(z-1)-\log.(z+1)$; or

$$2\sqrt{x}+\text{l}.\frac{c\sqrt{x}-c}{\sqrt{x}+1}.$$

123. We are now to consider any function whatever affected by the radical $\sqrt{(A+Bx\pm Cx^2)}$; which may be also expressed thus, $\sqrt{C}\sqrt{\left(\frac{A}{C}+\frac{B}{C}x\pm x^2\right)}$ There will be two cases, according as x^2 is positive or negative.

Case I. When the radical has the form $\sqrt{(a+bx+x^2)}$; let us assume

$$\sqrt{(a+bx+x^2)}=x\pm z,\text{ or }=z\pm x,$$

hence we find $a+bx=\pm 2xz+z^2$,

$$x=\frac{z^2-a}{b\mp 2z},$$

$$dx=\frac{2(bz\mp a\mp z^2)}{(b\mp 2z)^2}dz.$$

Thus the radical, or $x\pm z$, will be rendered rational, as well as the proposed function.

Inverse Method.

For example, let the fluxion be $\frac{dx}{\sqrt{(a+bx+x^2)}}$. By putting the radical $=z-x$, it becomes $\frac{z^2+bz+a}{2z+b}$, and the proposed fluxion is transformed to $\frac{2dz}{2z+b}$; the fluent of which is $\text{l}.(2z+b)+const.$ therefore

$$\int\frac{dx}{\sqrt{(a+bx+x^2)}}=\text{l}.\left\{c\left[x+\tfrac{1}{2}b+\sqrt{(a+bx+x^2)}\right]\right\}$$

Hence, $\int\frac{dx}{\sqrt{(x^2\pm a^2)}}=\text{l}.\left\{c\left[x+\sqrt{(x^2\pm a)}\right]\right\}$

Suppose $dy=dx\sqrt{(a^2+x^2)}$; we put $\sqrt{(a^2+x^2)}=z-x$, hence $dy=zdx-xdx$, and $y=-\frac{1}{2}x^2+\int zdx$. Instead of dx, put its value $\frac{dz}{2z^2}(a^2+z^2)$, and then, taking the fluent, and substituting, we find

$$y=c+\tfrac{1}{2}x\sqrt{(a^2+x^2)}+\tfrac{1}{2}a^2\text{l}.\left\{x+\sqrt{(a^2+x^2)}\right\}$$

If we put $dy=\frac{-dx}{\sqrt{(1-x^2)}}$ under this form $dy\sqrt{-1}=\frac{dx}{\sqrt{(x^2-1)}}$, taking the fluent, we have

$$y\sqrt{-1}=\text{l}.\left\{x+\sqrt{(x^2-1)}\right\}+c.$$

If y be an arc of a circle, x is its cosine (Rule (D), art. 26.) and $\sqrt{(x^2-1)}=\sqrt{-1}.\sin.y$; the equation of the fluents is therefore

$$\pm y\sqrt{-1}=\text{l}.\left\{\cos.y\pm\sqrt{-1}.\sin.y\right\}$$

The constant correction c in this case must be $=0$, because when $x=1$, y ought to vanish. Moreover we prefix the sign $\pm$, because the sign of $\sqrt{-1}$ may be either $+$ or $-$. Hence, e being the radical number in Napier's System of Logarithms (art. 12.) by the theory of logarithms,

$$\cos.y+\sqrt{-1}.\sin.y=e^{y\sqrt{-1}},$$

$$\cos.y-\sqrt{-1}.\sin.y=e^{-y\sqrt{-1}},$$

$$\cos.y=\frac{e^{y\sqrt{-1}}+e^{-y\sqrt{-1}}}{2},$$

$$\sin.y=\frac{e^{y\sqrt{-1}}-e^{-y\sqrt{-1}}}{2\sqrt{-1}}.$$

Lagrange considered these formulæ as one of the most beautiful analytical discoveries of the past age. They were first given by Euler. For a different mode of investigating them, see Arithmetic of Sines (29).

124. Case II. Let the radical be $\sqrt{(a+bx-x^2)}$; the preceding method cannot now be applied without introducing imaginary quantities: But in this case the trinomial $a+bx-x^2$ is the product of these two real factors.*

$$x+\tfrac{1}{2}\sqrt{(b^2+4a)}-\tfrac{1}{2}b,\ \tfrac{1}{2}\sqrt{(b^2+4a)}+\tfrac{1}{2}b-x.$$

Let them be denoted by $x-\alpha$ and $\beta-x$, and let us assume

$$\sqrt{(a+bx-x^2)}=\sqrt{\left\{(x-\alpha)(\beta-x)\right\}}=(x-\alpha)z.$$

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* To prove that the factors are always real, it is to be observed, that as $a+bx-x^2$ is supposed a positive quantity, $4a+4bx-4x^2=b^2+4a-(b-2x)^2$ will also be positive, but $(b-2x)^2$ will always be positive, therefore b^2+4a must also be positive, and $\sqrt{(b^2+4a)}$ a real quantity.

Then, squaring and suppressing the common factor, we have $\beta - x = (x - \alpha) z^2$; hence

$$x = \frac{\beta + \alpha z^2}{1 + z^2},\ d x = \frac{2(\alpha - \beta) z\, d z}{(1 + z^2)^2}.$$

$$\surd(a + b x - x^2) = (x - \alpha) z = \frac{(\beta - \alpha) z}{1 + z^2}.$$

These functions, as expressed by z, are all rational.

Let the fluxion $\frac{d x}{\surd(a + b x - x^2)}$ be proposed; then, making the above substitution, it is immediately transformed to $\frac{-2 d z}{1 + z^2}$, the fluent of which is -2 arc (tan. $= z$), therefore, because $z = \sqrt{\frac{\beta - x}{x - \alpha}}$, we have

$$\int \frac{d x}{\surd(a + b x - x^2)} = c - 2 \text{ arc } \left\{ \text{tan.} = \sqrt{\frac{\beta - x}{x - \alpha}} \right\}$$

If we suppose $a = 1$, $b = 0$, then, because $1 - x^2 = (1 + x)(1 - x)$, we have $\alpha = -1$, $\beta = 1$; in this case, the formula becomes

$$\int \frac{d x}{\surd(1 - x^2)} = c - 2 \text{ arc } \left\{ \text{tan.} = \sqrt{\frac{1 - x}{1 + x}} \right\}$$

The fluent of this fluxion is otherwise expressed by arc (sin. $= x$) $+ c'$, (Art. 114. Rule V.)

If $d y = d x \surd(a^2 - x^2)$, by applying the transformation, observing that $\alpha = -a$, $\beta = a$, we find

$$d y = \frac{-8 a^2 z^2 d z}{(1 + z^2)^3}.$$

The fluent may now be found by the rules for rational fractions.

The same mode of transformation will apply to the first case, when the roots of the equation $x^2 + b x + a = 0$ are real.

125. The radicals $\surd(a + b x + x^2)$, and $\surd(a + b x - x^2)$ may also be transformed by making $x = z - \frac{1}{2} b$ in the first case, and $x = z + \frac{1}{2} b$ in the second; they then take the forms $\surd(z^2 \pm a^2)$, and $\surd(a^2 \pm z^2)$. In the latter case, the irrationality may be removed by making $\surd(a^2 \pm z^2) = a - u z$, for then

$$z = \frac{2 a u}{u^2 \mp 1},\ d z = -2 a\, d u \frac{u^2 \pm 1}{(u^2 \mp 1)^2}.$$

It is thus that $\frac{d x}{\surd(2 b x - x^2)}$ becomes $\frac{-d z}{\surd(b^2 - z^2)}$, by putting $x = b - z$; the fluent may now be found by Rule V. art. 114. Again, making $\surd(b^2 - z^2) = b - u z$, the fluxion is changed from its second form to $\frac{2 d u}{u^2 + 1}$, a fluxion of which the fluent has been repeatedly assigned.

Of Binomial Fluxions.

ial 126. We propose now to find the fluent of

$$K x^m d x (a + b x^n)^p.$$

m, n, p, being any numbers whatever, whole or fractional, positive or negative.

In the first place, we put

$$z = a + b x^n;$$

Hence, $x = \left(\frac{z - a}{b}\right)^{\frac{1}{n}}$. Raising now both members of this equation to the power $m + 1$, and taking the fluxions, we get

$$x^m d x = \frac{(z - a)^{\frac{m+1}{n} - 1}}{n b^{\frac{m+1}{n}}} d z.$$

By substitution, the proposed fluxion becomes

$$\frac{K}{n b^{\frac{m+1}{n}}} (z - a)^{\frac{m+1}{n} - 1} \,.\, z^p\, d z.$$

Now if $\frac{m + 1}{n} = 1$, this fluxion has the form $K' z^p\, d z$, and its fluent may be found by Rule II. art. 114.

If $\frac{m + 1}{n} - 1 =$ some positive whole number r, the fluxion has the form $K' (z - a)^r z^p\, d z$. This expression may be developed, by the binomial theorem, into a series of a finite number of terms, each having the form $A z^q\, d z$; their fluents may therefore be found as in the former case, and thence the fluent of the proposed fluxion will be known.

If $\frac{m + 1}{n} - 1$ be a negative whole number $= -r$, the fluxion will have the form $\frac{K' z^p\, d z}{(z - a)^r}$; this expression may be transformed into a rational fraction, by assuming $z = u^q$, q being some whole number, such, that $p q$ is also a whole number, as has been shewn (art. 122).

Therefore, *if the exponent of* x *out of the binomial, increased by unity, be divisible by the exponent of* x *in the binomial, the fluent may always be found by the rules already explained.*

This, however, is not the only case in which we can find the fluent. If the part of the fluxion in the binomial be divided by x^n, and the part without the binomial be multiplied by x^{np}, which will not change the value, the fluxion will be expressed thus

$$K x^{m + np} (b + a x^{-n})^p\, d x,$$

and putting $z = b + a x^{-n}$, and proceeding, as in the former case, the fluxion is transformed to

$$\frac{K}{-n a^{\frac{m + np + 1}{-n}}} (z - b)^{\frac{m + np + 1}{-n} - 1} z^p\, d z.$$

From this expression we learn that the fluent may be found when $\frac{m + np + 1}{-n}$, or rather when $\frac{m + 1}{n} + p$ is a whole number. Hence it appears that when $\frac{m + 1}{n}$ is not a whole number, if p be added, and the result be a whole number, the fluent may still be found.

127. When p is a fraction, (which is the most important case,) and q its denominator, it is most convenient to assume $a + b x^n = z^q$. For example, let it be required to find the fluent of

$$x^{-2} d x (a + x^3)^{-\frac{5}{3}}.$$

In this case, $\frac{m + 1}{n} = -\frac{1}{3}$, to this, if we add $p = -\frac{5}{3}$, we find -2; therefore we must multiply and divide by $(x^3)^{-\frac{5}{3}}$ or x^{-5}, and then the fluxion becomes

Inverse Method.

$$x^{-7}\,dx\,(1+ax^{-3})^{-\frac{5}{3}};$$

We now make $1+ax^{-3}=z^3$, from which $x=\left(\frac{z^3-1}{a}\right)^{-\frac{1}{3}}$; by raising both sides to the $-$ 6th power, and taking the fluxions, we get

$$x^{-7}\,dx=-\frac{z^2(z^3-1)}{a^2}\,dz;$$

Hence, by substituting, the fluxion is transformed to

$$-\frac{1}{a^2}(1-z^{-3})\,dz,$$

of which the fluent is

$$c-\frac{1}{a^2}(z+\tfrac{1}{2}z^{-2})=c-\frac{3x^3+2a}{2a^2x^3\sqrt{(x^3+a)^2}}.$$

In like manner, the fluxion $x^3\,dx\,(a^2+x^2)^{\frac{1}{3}}$ becomes $\frac{3}{2}\,dz\,(z^6-a^2z^3)$, by making $a^2+x^2=z^3$; hence the fluent is

$$\tfrac{3}{56}\sqrt[3]{(a^2+x^2)^4}(4x^2-3a^2)+c.$$

128. When the indices do not satisfy one of the two conditions specified in art. 126, the fluxion cannot be rendered rational by any known method; we may, however, reduce it to the most simple form of which it will admit, by means of the formula $\int u\,dt=ut-\int t\,du$ (art. 114. rule IV.)

Let us put $u=z^p$ and $dt=x^m\,dx$, then $du=pz^{p-1}\,dz$; and $t=\frac{x^{m+1}}{m+1}$; hence,

$$\int x^m\,dx.z^p=\frac{x^{m+1}z^p}{m+1}-\frac{p}{m+1}\int z^{p-1}x^{m+1}\,dz.$$

But $z=a+bx^n$, and $dz=nbx^{n-1}\,dx$, therefore,

$$\int x^m dx.z^p=\frac{x^{m+1}z^p}{m+1}-\frac{nbp}{m+1}\int x^{m+n}dx.z^{p-1}\qquad(1)$$

Again, because $z^p=z^{p-1}z=z^{p-1}(a+bx^n)$, therefore

$$\int x^m\,dx.z^p=a\int x^m dx.z^{p-1}+b\int z^{p-1}x^{m+n}dx\qquad(2)$$

These values (1) and (2) being put equal, we find

$$\left.\begin{array}{l} b(m+1+np)\int z^{p-1}x^{m+n}dx= \\ \quad x^{m+1}z^p-a(m+1)\int z^{p-1}x^m dx \end{array}\right\}\qquad(3)$$

Change now $p-1$ into p, and $m+n$ into m, and we have

(A)

$$\int x^m dx.z^p=\frac{x^{m-n+1}z^{p+1}-a(m-n+1)\int x^{m-n}z^p\,dx}{b(m+1+np)}$$

and putting for the last term of equation (2) its value as given by (3), we get

(B)

$$\int x^m dx.z^p=\frac{z^px^{m+1}+anp\int x^m\,dx.z^{p-1}}{m+1+np}.$$

129. We shall now shew the use of these formulæ, in which it must be recollected that

$$z=a+bx^n.$$

1. Formula (A) makes the fluent of $x^m z^p dx$, depend on that of $x^{m-n}z^p dx$, and again this last on the fluent of $x^{m-2n}z^p\,dx$, and so on; it therefore serves *to diminish the exponent of* x *out of the binomial*, so as at last to bring the fluent to depend on that of $x^{m-in}z^p\,dx$, i being any whole positive number.

2. Formula (B) serves to diminish the exponent p by 1, 2, 3, &c. units, and thus to make the fluent of $x^m z^p\,dx$ depend on that of $x^m z^{p-i}\,dx$.

3. By resolving the equations (A), (B), so as to bring the fluent in the second member to one side of the equation, then substituting $m-n$ instead of m, in the first formula, and $p-1$ instead of p in the second, we find

(C)

$$\int x^m\,dx.z^p=\frac{x^{m+1}z^{p+1}-b(m+np+n+1)\int x^{m+n}z^p\,dx}{a(m+1)}$$

(D)

$$\int x^m dx.z^p=\frac{-x^{m+1}z^{p+1}+(m+np+n+1)\int x^m dx.z^{p+1}}{an(p+1)}$$

These formulæ serve, on the contrary, to increase the exponents of x, out of the binomial, and in it, and are useful, when the one or the other is negative.

4. These formulæ shew the law according to which the terms of a fluent are formed: thus, it is easy to see that the fluent of

$\frac{x^5\,dx}{\sqrt{(1-x^2)}}$ will have the form

$$(Ax^4+Bx^2+C)\sqrt{(1-x^2)}.$$

By taking the fluxion of this expression, we may find the co-efficients, A, B, C, by the method of indeterminate co-efficients, with less trouble than by applying the general formula.

130. We shall now indicate a mode of finding fluents, remarkable on account of its simplicity, and the numerous instances in which it may be applied. Taking the fluxion of $x^{n-1}\sqrt{(1-x^2)}$ we have $d\left\{x^{n-1}\sqrt{(1-x^2)}\right\}$

$$=(n-1)x^{n-2}\sqrt{(1-x^2)}\,dx-\frac{x^n\,dx}{\sqrt{(1-x^2)}};$$

By multiplying and dividing the first term of this fluxion by $\sqrt{(1-x^2)}$ we find, after taking the fluents and transposing,

(E)

$$\int\frac{x^n\,dx}{\sqrt{(1-x^2)}}=-\frac{x^{n-1}\sqrt{(1-x^2)}}{n}+\frac{n-1}{n}\int\frac{x^{n-2}\,dx}{\sqrt{(1-x^2)}}.$$

By treating the expression $x^{n-1}\sqrt{(x^2\pm1)}$ in the same manner, we get

(F)

$$\int\frac{x^n\,dx}{\sqrt{(x^2\pm1)}}=-\frac{x^{n-1}\sqrt{(x^2\pm1)}}{n}\mp\frac{n-1}{n}\int\frac{x^{n-2}\,dx}{\sqrt{(x^2\pm1)}}.$$

By these formulæ, we may find the fluent of every function affected by the radical $\sqrt{(A+Bx+Cx^2)}$, since every fluxion involving this quantity may be reduced at last to the form $\frac{z^n\,dz}{\sqrt{(a^2\pm z^2)}}$ or $\frac{z^n\,dz}{\sqrt{(z^2\pm a^2)}}$ (125)

By dividing the numerator and denominator by a, the radicals in these expressions may be changed into $\sqrt{(1\pm x^2)}$ and $\sqrt{(x^2\pm1)}$, and then formulæ (E) and (F) make the fluent at last depend on

$$\int\frac{x\,dx}{\sqrt{(x^2\pm1)}}\text{ or }\int\frac{x\,dx}{\sqrt{(1\pm x^2)}},\text{ if } n \text{ is odd};$$

$$\int\frac{dx}{\sqrt{(x^2\pm1)}}\text{ or }\int\frac{dx}{(\sqrt{1\pm x^2})},\text{ if } n \text{ is even}.$$

The two first fluents come immediately under Rule II. art. 114, by putting $x^2\pm1$, or $1\pm x^2=z$, from which $x\,dx=$ or $-x\,dx=dz$; the third has been assigned in art. 124; the fourth is the arc, of which the sine is x.

For example, we have

Inverse Method.

$$\int\frac{x\,dx}{\sqrt{(1-x^2)}}=-\sqrt{(1-x^2)}+c.$$

$$\int\frac{x^3\,dx}{\sqrt{(1-x^2)}}=-\left(\frac{x^2}{3}+\frac{1.2}{1.3}\right)\sqrt{(1-x^2)}+c.$$

$$\int\frac{x^2\,dx}{\sqrt{(1-x^2)}}=-\tfrac{1}{2}x\sqrt{(1-x^2)}+\tfrac{1}{2}\text{ arc. (sin.}=x)+c.$$

$$\int\frac{x^4\,dx}{\sqrt{(1-x^2)}}=-\left(\frac{x^3}{4}+\frac{1.3\,x}{2.4}\right)\sqrt{(1-x^2)}$$
$$+\frac{1.3}{2.4}\text{ arc (sin.}=x)+c.$$

131. However, if n were negative, formulæ (E) and and (F) would no longer apply; but, by making $x=\frac{1}{z}$, we find,

$$\frac{dx}{x^n\sqrt{(1-x^2)}}=\frac{-z^{n-1}\,dz}{\sqrt{(z^2-1)}},$$
$$\frac{dx}{x^n\sqrt{(x^2\pm1)}}=-\frac{z^{n-1}\,dz}{\sqrt{(1\pm z^2)}}.$$

Besides, we may find formulæ which shall apply directly, by proceeding as in last article; for, taking the fluxion of $x^{n+1}\sqrt{(1-x^2)}$, we get

$$\left.\begin{aligned}\int\frac{dx}{x^n\sqrt{(1-x^2)}}=&-\frac{\sqrt{(1-x^2)}}{(n-1)\,x^{n-1}}\\&+\frac{n-2}{n-1}\int\frac{dx}{x^{n-2}\sqrt{(1-x^2)}}\end{aligned}\right\}\quad\text{(G)}$$

When n is an odd number, this formula makes the fluent at last depend on $\int\frac{dx}{x\sqrt{(1-x^2)}}$, which, by Ex. 2. art. 33, is

$$c-\mathrm{l.}\left\{\frac{\sqrt{(1+x)}+\sqrt{(1-x)}}{\sqrt{(1+x)}-\sqrt{(1-x)}}\right\}$$
$$=c-\mathrm{l.}\left\{\frac{1+\sqrt{(1-x^2)}}{x}\right\}.$$

In like manner, we find

$$\left.\begin{aligned}\int\frac{x^m\,dx}{\sqrt{(2ax-x^2)}}=&-\frac{x^{m-1}}{m}\sqrt{(2ax-x^2)}\\&+\frac{(2m-1)\,a}{m}\int\frac{x^{m-1}\,dx}{\sqrt{(2ax-x^2)}}\end{aligned}\right\}\quad\text{(H)}$$

Of Exponential Functions.

132. It appears, from art. 26, rule (C), that

$$\int a^x\,dx=\frac{a^x}{\mathrm{l.}(a)}.$$

Let V be any algebraic function of a^x, then, because $dx=\frac{d\,(a^x)}{a^x\,\mathrm{l.}\,(a)}$, if we put $a^x=u$, we have $\mathrm{V}\,dx=\frac{\mathrm{V}\,du}{u\,\mathrm{l.}\,(a)}$, an expression which, with regard to u, has an algebraic form. For example, let $\mathrm{V}=\frac{a^x}{\sqrt{(1+a^{nx})}}$,

$$\text{then }\frac{a^x\,dx}{\sqrt{(1+a^{nx})}}=\frac{du}{\mathrm{l.}\,(a)\sqrt{1+u^n}}.$$

The fluent of this last expression may be found by the formula already investigated.

Let z be any function of x; then, e being the number of which Nap. log. is unity, we have $d\,(ze^x)=e^x dz+e^x z\,dx$; therefore,

$$\int e^x\,dx\left(z+\frac{dz}{dx}\right)=z\,e^x+c.$$

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For example, let $z=x^3-1$; then $\frac{dz}{dx}=3\,x^2$, and

$$\int e^x\,dx\,(3\,x^2+x^3-1)=e^x\,(x^3-1)+c.$$

133. In other cases, we may have recourse to the method of *integrating by parts*, (art. 114. Rule IV.) Thus, let the fluxion be $x^n\,dx.a^x$; then, by the formula $\int u\,dt=ut-\int t\,du$, making $u=x^n$, $dt=a^x dx$, we find

$$\int x^n\,dx.a^x=\frac{a^x.x^n}{\mathrm{l.}\,(a)}-\frac{n}{\mathrm{l.}\,(a)}\int a^x x^{n-1}\,dx.$$

By treating $a^x x^{n-1}\,dx$ in the same manner, and repeating this as often as is necessary, we find $\int a^x x^n\,dx=$

$$a^x\left\{\frac{x^n}{\mathrm{l.}(a)}-\frac{n\,x^{n-1}}{\mathrm{l.}^2\,(a)}+\frac{n\,(n-1)\,x^{n-2}}{\mathrm{l.}^3\,(a)}-\ldots\right.$$
$$\left.\ldots\pm\ldots\frac{1.2.3\ldots n}{\mathrm{l.}^{n+1}\,(a)}\right\}+c.$$

In this series, $\mathrm{l}^2\,(a)$, $\mathrm{l.}^3\,(a)$, &c. mean the square, the cube, &c. of l. (a).

134. If the exponent n is negative, by following the same method, we may increase the exponent of x. Accordingly, from the formula $\int u\,dt=ut-\int t\,du$, making $u=a^x$, and $dt=\frac{dx}{x^n}$, we find

$$\int\frac{a^x dx}{x^n}=\frac{-a^x}{(n-1)\,x^{n-1}}+\frac{\mathrm{l.}(a)}{n-1}\int\frac{a^x dx}{x^{n-1}}.$$

By repeating this transformation, we bring the fluent $\int\frac{a^x dx}{x^n}$ to depend on $\int\frac{a^x dx}{x}$. This last fluent has long exercised the ingenuity of analysts in endeavouring to reduce it to circular arcs or logarithms, but without success. It appears to be a transcendental of a peculiar kind. For want of a rigorous method, we may employ a series; thus, putting A for l.(a), we have, by art. 53,

$$a^x=1+\mathrm{A}\,x+\frac{\mathrm{A}^2x^2}{2}+\frac{\mathrm{A}^3x^3}{2.3}+\text{\&c.}$$

Therefore, multiplying by $\frac{dx}{x}$, and taking the fluents, we find $\int\frac{a^x dx}{x}=$

$$\mathrm{l.}(x)+\mathrm{A}\,x+\frac{\mathrm{A}^2x^2}{2.2}+\frac{\mathrm{A}^3\,x^3}{3.2.3}+\cdots+c.$$

135. If n be a fraction, either of the preceding methods will serve to reduce the exponent of x to some fraction between 0 and +1 or — 1; and then, recourse may be had to the method of infinite series, which we are afterwards to explain.

Whatever has been done in regard to the fluxion of $x^n\,dx.a^x$, will apply equally to $z\,dx.a^x$, supposing z to be any function of x whatever.

Of Logarithmic Functions.

Of logarithmic functions.

136. Let it now be required to find the fluent of $z\,dx\,\mathrm{l.}^n\,(x)$, putting $\mathrm{l.}^n\,(x)$ to denote the nth power of the Napierean log. of x, and supposing z to be any algebraic function of x.

Let n be a positive integer, then recurring to the

Inverse Method.

formula $\int u\,d\,t = u\,t - \int t\,d\,u$, and making $u = \mathrm{l.}^n(x)$, and $d\,t = z\,d\,x$, so that $t = \int z\,d\,x$, and $d\,u = n\ \mathrm{l.}^{n-1}(x)\frac{x}{d\,x}$, we have

$$\int z\,d\,x\,\mathrm{l.}^n(x) = \mathrm{l.}^n(x)\int z\,d\,x - n\int \mathrm{l.}^{n-1}(x)\frac{d\,x}{x}\int z\,d\,x,$$

as $\int z\,d\,x$ is supposed known by the principles already established, the proposed fluent is by this formula made to depend on another of the same kind, in which the exponent of the logarithm is an unit less.

Thus, if $z = x^m$, we have

$$\int x^m d\,x.\mathrm{l.}^n(x) = \frac{x^{m+1}}{m+1}\mathrm{l.}^n(x) - \frac{n}{m+1}\int \mathrm{l.}^{n-1}(x).\,x^m\,d\,x.$$

By applying the formula to this last fluent, and again to that which results, and so on, we get

$$\int x^m\,\mathrm{l.}^n(x)\,d\,x =$$

$$x^{m+1}\left\{\frac{\mathrm{l.}^n(x)}{m+1} - \frac{n\,\mathrm{l.}^{n-1}(x)}{(m+1)^2} + \frac{n(n-1)\,\mathrm{l.}^{n-2}(x)}{(m+1)^3} - \&c.\right\} + c.$$

137. But if n is a whole negative number, we must apply the formula $\int u\,d\,t = u\,t - \int t\,d\,u$, so as to increase the exponent of the logarithm. This will happen, if, in the expression

$$\frac{z\,d\,x}{\mathrm{l.}^n(x)} = \frac{z\,x}{-n+1}\times(-n+1)\,\mathrm{l.}^{-n}(x)\cdot\frac{d\,x}{x},$$

we make $z\,x = u$, and $\mathrm{l.}^{-n}(x)\cdot\frac{d\,x}{x} = d\,t$, by which $\frac{\mathrm{l.}^{-n+1}(x)}{-n+1} = t$, for we then have

$$\int\frac{z\,d\,x}{\mathrm{l.}^n(x)} = \frac{z\,x}{-n+1}\,\mathrm{l.}^{-n+1}(x)$$

$$+\frac{1}{n-1}\int \mathrm{l.}^{-n+1}(x).d\,(z\,x).$$

Let us suppose $z = x^m$; then this formula becomes

$$\int\frac{x^m\,d\,x}{\mathrm{l.}^n(x)} = \frac{-x^{m+1}}{(n-1)\,\mathrm{l.}^{n-1}(x)} + \frac{m+1}{n-1}\int\frac{x^m\,d\,x}{\mathrm{l.}^{n-1}(x)};$$

By transforming this last fluent in the same manner, and again the fluent that thence results, and so on, we at last make the proposed fluent depend on $\int\frac{x^m\,d\,x}{\mathrm{l.}(x)}$.

Now, put $x^{m+1} = z$, then $\mathrm{l.}(x) = \frac{\mathrm{l.}(z)}{m+1}$, and $x^m\,d\,x = \frac{d\,z}{m+1}$, therefore,

$$\frac{x^m d\,x}{\mathrm{l.}(x)} = \frac{d\,z}{\mathrm{l.}(z)} = \frac{e^u d\,u}{u},$$

where u is put for $\mathrm{l.}(z)$. The fluent of this last function can only be expressed by a series, as we have already observed in art. 134.

138. When n is a positive or negative fraction, the fluent may be made to depend upon a similar fluent, in which n is between 0 and $+1$, or -1. This last can only be expressed by an infinite series.

Of Circular Functions.

Of circular functions.

139. There are several methods of finding the fluents of such expressions as contain trigonometrical functions.

I. *Method.* We may make sin. x, or cos. $x = z$, and then any fluxion containing the sine and cosine of an arc, and its fluxion may be transformed into an algebraic function. For example, let sin. $x = z$, then

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$$\cos.\,x = \surd(1 - z^2),\ d\,x = \frac{d\,z}{\surd(1 - z^2)};$$

$$\sin.^m x\,.\cos.^n x\,d\,x = z^m\,d\,z\,(1 - z^2)^{\frac{n-1}{2}}$$

1. If n is an odd number, the radical in the transformed expression disappears.

2. If m is an odd number, then the exponent of z out of the binomial, when increased by unity, will be a multiple of 2, its exponent in the binomial. Thus, one of the conditions (the first) of art. 126, will be satisfied; and therefore the fluxion may be made rational.

3. If m and n are even numbers, then the second condition of art. 126. will be satisfied. As an example of this method, $\int \sin.^3 x\,d\,x$.

$$\int\frac{z^3\,d\,z}{\surd(1 - z^2)} = -\tfrac{1}{3}\cos.\,x\,(3 - \cos.^2 x) + c.$$

140. II. *Method.* It follows, from art. 26. rule D, that

$$\int d\,x\cos.\,k\,x = \frac{1}{k}\sin.\,k\,x + c,$$

$$\int d\,x\sin.\,k\,x = -\frac{1}{k}\cos.\,k\,x + c.$$

Now, we have shewn (ARITHMETIC OF SINES) how to develope the powers of sin. x and cos. x into series, the terms of which are multiples of x; therefore, every fluxion of the form $\cos.^m x\,.\,d\,x$, or $\sin.^m x\,d\,x$, may be transformed into a series of fluxions, of the forms $d\,x\cos.\,k\,x$, $d\,x\sin.\,k\,x$; and hence the fluents may be found from the preceding formulæ. Thus, because

$$\cos.^5 x = \frac{1}{16}\cos.\,5\,x + \frac{5}{16}\cos.\,3\,x + \frac{5}{8}\cos.\,x,$$

(ARITHMETIC *of Sines*, Formulæ (S), therefore,

$$\int\cos.^5 x\,d\,x = \frac{1}{80}\sin.\,5\,x + \frac{5}{48}\sin.\,3\,x + \frac{5}{8}\sin.\,x + c.$$

This method is often used, because it is easier to find the sines and cosines of the multiples of an arc than the powers of its sine and cosine. As the expression $\cos.^m x\sin.^n x$, may also be resolved into a series, of which the terms are the sines and cosines of the multiples of x, the fluent of $\cos.^m x\sin.^n x\,d\,x$, may be found as in the preceding example.

141. III. *Method.* The sine and cosine of an arc may be expressed as exponential quantities, by the formulæ of art. 123; and then the fluents of any fluxions into which they enter, may be found by art. 132--134.

142. IV. *Method.* This proceeds by the formula $\int u\,d\,t = u\,t - \int t\,d\,u$, which we have already so often employed. Let the fluxion be $d\,x\sin.^m x\cos.^n x$, which may be considered as the product of $d\,x\sin.\,x\cos.^n x$, and $\sin.^{m-1} x$; then, putting $u = \sin.^{m-1} x$, and $d\,t = d\,x\sin.\,x\cos.^n x$, from which it follows, that $t = -\frac{\cos.^{n+1}}{n+1}$, and $d\,u = (m-1)\,d\,x\cos.\,x\sin.^{m-2} x$, we have

$$\int d\,x\sin.^m\cos.^n x = -\frac{\sin.^{m-1} x}{n+1}\cos.^{n+1} x$$

$$+\frac{m-1}{n+1}\int\cos.^{n+2} x\sin.^{m-2} x\,d\,x.$$

From this expression, by putting for $\cos.^{n+2} x$, its value $\cos.^n x\,(1 - \sin.^2 x)$, and transposing, we find

1

Inverse Method.

(I)

$$\int dx \sin.^m x \cos.^n x = -\frac{\sin.^{m-1} x \cos.^{n+1} x}{m+n} + \frac{m-1}{m+n}\int dx \sin.^{m-2} x \cos.^n x.$$

By resolving the proposed fluxion into the two factors $d x \cos. x \sin.^m x$, and $\cos.^{n-1} x$, and proceeding in the same manner, we find

(K)

$$\int d x \sin.^m x \cos.^n x = \frac{\sin.^{m+1} x \cos.^{n-1} x}{m+n} + \frac{n-1}{m+n}\int d x \sin.^m x \cos.^{n-1} x.$$

One of these formulæ serves to depress the exponent of the sine, and the other that of the cosine; and, by their joint application, the fluent may be found when m and n are any two positive integer numbers. For example,

$$\int d x \sin.^3 x \cos.^2 x = -\tfrac{1}{5}\sin.^2 x \cos.^3 x + \tfrac{2}{5}\int d x \sin. x \cos.^2 x$$

$$\int d x \sin. x \cos.^2 x = \tfrac{1}{3}\sin.^2 x \cos. x + \tfrac{2}{3}\int d x \sin. x.$$

Observing, now, that $\int d x \sin. x = -\cos. x$, we find, after collecting all the terms, $\int d x \sin.^3 x \cos.^2 x =$
$\cos. x\left(-\tfrac{1}{5}\sin.^2 x \cos.^2 x + \tfrac{2}{15}\sin.^2 x - \tfrac{2}{15}\right) + c.$

143. But if m and n are negative, these formulæ require some modification. The first gives

(L)

$$\int \frac{d x \sin.^m x}{\cos.^n x} = -\frac{\sin.^{m-1} x}{m-n \cos.^{n-1} x} + \frac{m-1}{m-n}\int \frac{d x \sin.^{m-2} x}{\cos.^n x}.$$

This brings the fluent to depend on that of $\frac{d x \sin. x}{\cos.^n x}$, or of $\frac{d x}{\cos.^n x}$, according as m is an odd or an even number. By putting $\cos. x = z$, the first of these two fluxions becomes $-\frac{d z}{z^n}$: the fluent of this is obvious; the fluent of the other fluxion will be shewn presently.

The second of the two general formulæ, by making n negative, and bringing the fluent in the second member to stand alone on one side of the equation, and lastly, changing n into $2-n$, gives

(M)

$$\int \frac{d x \sin.^m x}{\cos.^n x} = \frac{\sin.^{m+1} x}{(n-1)\cos.^{n-1} x} - \frac{m-n+2}{n-1}\int \frac{d x \sin.^m x}{\cos.^{n-2} x}.$$

By this, the fluent sought is reduced to that of $d x \sin.^m x$, or to $\frac{d x \sin.^m x}{\cos. x}$, according as n is even or odd. The second is found by formula (I); the first is presently to be noticed.

144. If we make m or $n = 0$, we have

$$\int \sin.^m x\, d x = \frac{-\cos. x \sin.^{m-1} x}{m} + \frac{m-1}{m}\int d x \sin^{m-2} x$$

$$\int \cos.^n x\, d x = \frac{\sin. x \cos.^{n-1} x}{n} + \frac{n-1}{n}\int d x \cos.^{n-2} x$$

$$\int \frac{d x}{\sin.^m x} = \frac{-\cos. x}{(m-1)\sin.^{m-1} x} + \frac{m-2}{m-1}\int \frac{d x}{\sin.^{m-2} x}$$

$$\int \frac{d x}{\cos.^n x} = \frac{\sin. x}{(n-1)\cos.^{n-1} x} + \frac{n-2}{n-1}\int \frac{d x}{\cos.^{n-2} x}.$$

145. When the exponents of the sine and cosine are both negative, we multiply the numerator by $\cos.^2 x + \sin.^2 x = 1$, and we have

$$\frac{d x}{\sin.^m x \cos.^n x} = \frac{d x}{\sin.^{m-2} x \cos.^n x} + \frac{d x}{\sin.^m x \cos.^{n-2} x}.$$

By repeating this operation, we come to fractions having only $\sin. x$, or $\cos. x$, in the denominator.

When $m = n$, as $\sin. x \cos. x = \frac{1}{2}\sin. 2 x$, the denominator $\sin.^m x \cos.^m x$ becomes $\frac{1}{2^m}\sin.^m (2 x)$.

146. We shall conclude this branch of the subject, by finding the fluents of four of the more elementary circular functions.

The first is $\frac{d x}{\sin. x} = \frac{d x \sin. x}{1-\cos.^2 x}$; put $\cos. x = z$, and it becomes $-\frac{d z}{1-z^2}$. The fluent of this expression has been given in Art. 119. Case I; thence

$$\int \frac{d x}{\sin. x} = \text{l.}\,(c) + \tfrac{1}{2}\,\text{l.}\left\{\frac{1-\cos. x}{1+\cos. x}\right\} = \text{l.}\left\{\frac{c\sqrt{(1-\cos. x)}}{\sqrt{(1+\cos. x)}}\right\}.$$

And as $\cos. x = 1 - 2\sin.^2 \frac{1}{2} x = 2\cos.^2 \frac{1}{2} x - 1$ (ARITHMETIC *of Sines*, formulæ (T); therefore, $1-\cos. x = 2\sin.^2 \frac{1}{2} x$, and $1+\cos. x = 2\cos.^2 \frac{1}{2} x$, so that

$$\frac{1-\cos. x}{1+\cos. x} = \frac{\sin.^2 \frac{1}{2} x}{\cos.^2 \frac{1}{2} x} = \tan.^2 \tfrac{1}{2} x \text{; hence also}$$

$$\int \frac{d x}{\sin. x} = \text{l.}\,(\tan. \tfrac{1}{2} x) + c.$$

2. By a like process, putting $\cos. x = z$, we find

$$\int \frac{d x}{\cos. x} = \text{l.}\left\{\frac{c\sqrt{(1+\sin. x)}}{\sqrt{(1-\sin. x)}}\right\}.$$

If in the formula $\frac{1-\cos. x}{1+\cos. x} = \tan.^2 \frac{1}{2} x$, we put $\frac{1}{2}\pi - x$ instead of x, (π being 180°), we get

$$\frac{1-\sin. x}{1+\sin. x} = \tan.^2 (\tfrac{1}{4}\pi - \tfrac{1}{2} x) = \frac{1}{\tan.^2 (\frac{1}{4}\pi + \frac{1}{2} x)},$$

therefore, $\int \frac{d x}{\cos. x} = \text{l.}\left\{\tan. (\frac{1}{4}\pi + \frac{1}{2} x)\right\} + c'$.

3. Let the fluxion be $\frac{d x. \cos. x}{\sin. x}$. In this case, the numerator is the fluxion of the denominator, therefore (Art. 114. Rule III.)

$$\int \frac{d x \cos. x}{\sin. x} = \int \frac{d x}{\tan. x} = \int d x \cot. x = \text{l.}\,(c \sin. x).$$

4. In like manner,

$$\int \frac{d x \sin. x}{\cos. x} = \int d x \tan. x = \int \frac{d x}{\cot. x} = \text{l.}\left\{\frac{c}{\cos. x}\right\}.$$

Of the Constant Correction of a Fluent.

Of the constant correction of a fluent.

147. Let P be the variable part of the fluent of $z\,d x$, (z being a function of x), and c the constant quantity which ought to be added, in order that the fluent may be the most general possible, we have $\int z\,d x = \text{P} + c$. While we regard the fluent merely as a function, of which the fluxion is to be identical with a proposed fluxion, c may be any constant quantity whatever; but when the fluent results from the solution of a particular problem, it generally happens, that the constant quantity c has to satisfy some condition, which restricts it to a determinate value. If, for example, it be propo-

Fig. 14.

sed to find the area CEQP$=s$, (Fig. 14.) comprehended between the ordinates CE, PQ, of which the abscissæ are AE$=a$, and AQ$=b$; because $ds=y\,dx$ (art. 71.) in general, $s=\int y\,dx=\text{P}+c$. But let us suppose, that when x becomes a, P becomes A, then, corresponding to the particular case of $x=a$, $s=\text{A}+c$. Now in the present case, when $x=a$, then $s=0$; therefore, c is restricted to the magnitude that makes $\text{A}+c=0$, that is, $c=-\text{A}$, hence $s=\text{P}-\text{A}$; and if in this expression we put b instead of x, we have the area, or the value of s, between the limits of $x=a$, and $x=b$.

Again, let us suppose that u and x are two variable quantities, so related, that $du=x^n\,dx$, then, in general, $u=\frac{x^{n+1}}{n+1}+c$. But let us farther suppose it known, that when $x=a$, then $u=k$. In this case, $k=\frac{a^{n+1}}{n+1}+c$, and hence $c=k-\frac{a^{n+1}}{n+1}$, and, in the question under consideration, it can have no other value; therefore $u=\frac{x^{n+1}-a^{n+1}}{n+1}+k$. In this manner, we may determine the value of the constant correction c.

Supposing a to be the value of x, when the fluent $=0$, then a is called the *origin* of the fluent; and it is said *to begin* when x has that value; and *to end* when x has completed the change in its magnitude, so as to have passed from $x=a$ to $x=b$. These values of x are the *limits* of the fluent. When neither the origin nor the limits of a fluent are assigned, it is said to be *indefinite*; and, in order to be *complete*, it must contain a *constant arbitrary quantity*. When the limits of the fluent are assigned, it is *definite*. Thus, supposing A to be the value of the fluent when $x=a$, and B its value when $x=b$, then B—A is the definite fluent. As c has the same value in A and B, it disappears from the definite fluent, which may therefore be found by putting $x=a$, and $x=b$ in the indefinite fluent, and subtracting the first result from the second. All this will be illustrated by examples as we proceed.

Fluents found by Infinite Series.

Fluents found by infinite series.

148. When a fluent cannot be assigned in finite terms by algebraic quantities, nor by circular arcs nor logarithms, then recourse must be had to methods of approximation. Let $\int z\,dx$ be the fluent. If we develope the function z into a series, proceeding according to the ascending or descending powers of x, and multiply the terms by dx, and then take the fluents, their sum will evidently be the fluent sought. We shall now give examples.

Ex. 1. Let the fluent of $\frac{dx}{x+a}$ be required, which, we know, comprehends in it l.$(a+x)$, (Rule (B), art. 26). By algebraic division,

$$\frac{1}{a+x}=\frac{1}{a}-\frac{x}{a^2}+\frac{x^2}{a^3}-\frac{x^3}{a^4}+\&\text{c.}$$

Therefore, multiplying by dx, and taking the fluent of each term, we find

$$\int\frac{dx}{a+x}=\frac{x}{a}-\frac{x^2}{2a^2}+\frac{x^3}{3a^3}-\frac{x^4}{4a^4}+\&\text{c.}+c.$$

In the most general expression for the fluent, c may be any constant quantity whatever; but regarding it as expressing the value of l. $(x+a)$, c is restricted to a particular value. To determine this, we know that when $x=0$, then l. $(x+a)$ becomes l. (a); but when $x=0$, all the terms of the series except c vanish, therefore $c=\text{l.}\ (a)$, and

$$\text{l.}\ (x+a)=\text{l.}\ (a)+\frac{x}{a}-\frac{x^2}{2a^2}+\frac{x^3}{3a^3}-\&\text{c.}$$

as we have already found, (Art. 53.)

Ex. 2. To find the fluent of $\frac{dx}{1+x^2}$, we expand it by division into the series $dx-x^2dx+x^4dx-x^6dx+$ &c. then taking the fluents of the terms, we find

$$\int\frac{dx}{1+x^2}=x-\tfrac{1}{3}x^3+\tfrac{1}{5}x^5-\tfrac{1}{7}x^7+\&\text{c.}+c.$$

As this fluxion is that of an arc, of which the tangent is x, and radius unity, (Art. 35), by giving a suitable value to c, the fluent must express that arc. To determine c, we must consider, that when the tangent $=0$, then the arc $=0$; therefore the fluent ought to vanish when $x=0$; hence c must be $=0$, and

$$\text{arc (tan.}=x)=x-\frac{x^3}{3}+\frac{x^5}{5}-\frac{x^7}{7}+\&\text{c.}$$

which is the series originally found by James Gregory, and perhaps afterwards by Leibnitz. Hence the ratio of the diameter to the circumference may be found, (see Arithmetic *of Sines*, Art. 32); and the number 3.14159265 . . . which expresses the measure of two right angles, and is commonly indicated by the character π.

Ex. 3. Let the fluent of $\frac{dx}{\sqrt{(1-x^2)}}$ or $dx(1-x^2)^{-\frac{1}{2}}$ be required. In this case, we must expand the radical into a series by the binomial theorem, (Art. 53. or 54. See also Algebra, Art. 323.) which will give $(1-x^2)^{-\frac{1}{2}}=1+\frac{x^2}{2}+\frac{1.3\,x^4}{2.4}+$ &c. hence we have

$$\int\frac{dx}{\sqrt{(1-x^2)}}=x+\frac{x^3}{2.3}+\frac{3\,x^5}{2.4.5}+\frac{3.5\,x^7}{2.4.6.7}+\&\text{c.}+c.$$

This fluxion is the same as that of an arc, of which the sine is x, (Rule (D) Art. 26.); now the arc vanishes when $x=0$, therefore, by making $c=0$, the series will express the arc. If we suppose the arc to be $\frac{1}{12}$ of the circumference, or 30°, then $x=\frac{1}{2}$. Therefore observing, that the arc of 30° is $\frac{1}{6}\pi$, we have

$$\tfrac{1}{6}\pi=\tfrac{1}{2}+\frac{1}{2.3.2^3}+\frac{1.3}{2.4.5.2^5}+\frac{1.3.5}{2.4.6.7.2^7}+\&\text{c.}$$

149. John Bernoulli invented a general expression for any fluent, which is analogous to Taylor's formula for any function of a binomial. Let z be any function of x, then any fluent whatever, containing only one variable quantity, may be represented by $\int z\,dx$: employing now the formula $\int u\,dt=ut-\int t\,du$, we have

$$\int z\,dx=zx-\int x\,dz$$

$$\int x\,dz=\int\frac{dz}{dx}x\,dx=\tfrac{1}{2}x^2\frac{dz}{dx}-\tfrac{1}{2}\int x^2\,\frac{d^2z}{dx}$$

$$\int x^2\frac{d^2z}{dx}=\int\frac{d^2z}{dx^2}x^2\,dx=\tfrac{1}{3}x^3\frac{d^2z}{dx^2}-\tfrac{1}{3}\int x^3\,\frac{d^3z}{dx^3}$$

$$\int x^3\frac{d^3z}{dx^2}=\int\frac{d^3z}{dx^3}x^3\,dx=\tfrac{1}{4}x^4\frac{d^3z}{dx^3}-\tfrac{1}{4}\int x^4\,\frac{d^4z}{dx^3},\ \&\text{c.}$$

Instead of $\int x\,dz$, $\int x^2\,\frac{d^2z}{dx}$, &c. substitute their values, and put c for the constant quantity, which serves to complete the fluent, and we have

$$\int z\,dx = c + zx - \frac{dz}{dx}\frac{x^2}{2} + \frac{d^2z}{dx^2}\frac{x^3}{2.3} - \&c.$$

This is *Bernoulli's Theorem*. It may be otherwise readily deduced from Taylor's theorem. If in the developement we make $x = 0$, all the terms, with the exception of the constant quantity, vanish, therefore c is the value of the fluent when $x = 0$.

Example. To find the fluent $\int \frac{dx}{a+x} = \text{l.}\,(a+x)$ by this method: When $x = 0$, then $\text{l.}\,(a+x)$ becomes $\text{l.}\,(a)$, therefore $c = \text{l.}\,(a)$: And because $z = \frac{1}{a+x}$, therefore $\frac{dz}{dx} = \frac{-1}{(a+x)^2}$, $\frac{d^2z}{dx^2} = \frac{2}{(a+x)^3}$, &c. and $\text{l.}(a+x) = \text{l.}\,(a) + \frac{x}{a+x} + \frac{x^2}{2(a+x)^2} + \frac{x^3}{3(a+x)^3} +$ &c.

This series differs from that found in last article, but the one may be transformed into the other.

Quadrature of Curves.

Quadrature of curves. 150. Let $x = \text{AQ}$, (Fig. 14.) be the abscissa of a curve, $y = \text{PQ}$ the ordinate, and $s =$ the area CEQP, comprehended between the indefinite ordinate PQ, and CE an ordinate having a given position. We have found, (art. 71.) that $ds = y\,dx$, so that $s = \int y\,dx$. We are now to apply this formula to particular examples.

Fig. 14.

Fig. 10. **Example 1.** Let the curve be a parabola, (Fig. 10.) in this case, a being put for the parameter, $y^2 = ax$, and $y = a^{\frac{1}{2}}x^{\frac{1}{2}}$, and $ds = y\,dx = a^{\frac{1}{2}}x^{\frac{1}{2}}dx$, therefore, taking the fluent, (art. 114),

$$s = \int y\,dx = \tfrac{2}{3}a^{\frac{1}{2}}x^{\frac{3}{2}} + c = \tfrac{2}{3}yx + c.$$

Let us suppose the fluent to begin at the vertex A; then, when $x = 0$ we ought to have $s = 0$. The general equation of the fluents in this case becomes $0 = 0 + c$, therefore $c = 0$; and so $s = \frac{2}{3}yx$, which agrees with what was found in Conic Sections, (Sect. VII. Prop. 1.). If s were supposed to begin when x had some given value b, we would have $0 = \frac{2}{3}a^{\frac{1}{2}}b^{\frac{3}{2}} + c$; then $c = -\frac{2}{3}a^{\frac{1}{2}}b^{\frac{3}{2}}$, and $s = \frac{1}{2}a^{\frac{1}{2}}.(x^{\frac{3}{2}} - b^{\frac{3}{2}})$.

Fig. 9. Ex. 2. Let the curve be a circle, (Fig. 9.) and suppose the origin of the co-ordinates $x = \text{OQ}$ and $y = \text{PQ}$ to be at O the centre; put a for the radius. By the nature of the circle $y = \sqrt{(a^2 - x^2)}$, therefore, $y\,dx = dx\sqrt{(a^2 - x^2)}$: Apply to this fluxion the formula $\int u\,dt = ut - \int t\,du$, (making $\sqrt{(a^2 - x^2)} = u$, and $x = t$) and we shall have

$$\int dx\sqrt{(a^2 - x^2)} = x\sqrt{(a^2 - x^2)} + \int \frac{x^2\,dx}{\sqrt{(a^2 - x^2)}}.$$

Again, $\frac{x^2\,dx}{\sqrt{(a^2 - x^2)}} = \frac{a^2\,dx}{\sqrt{(a^2 - x^2)}} - dx\sqrt{(a^2 - x^2)}$, as appears by bringing the quantities to a common denominator; therefore, substituting, and putting xy for $x\sqrt{(a^2 - x^2)}$,

$$s = \int y\,dx = \tfrac{1}{2}xy + \tfrac{1}{2}a\int \frac{a\,dx}{\sqrt{(a^2 - x^2)}}.$$

Now, (Art. 114, Rule V.) the fluent of $\frac{a\,dx}{\sqrt{(a^2 - x^2)}}$ is the circular arc of which the radius is a and the sine x, and this arc, supposing AD a quadrant, is PD; let it be denoted by z, and we have

$$s = \tfrac{1}{2}xy + \tfrac{1}{2}az + c.$$

This is the complete fluent, which holds true, whatever be its origin. Let us now suppose that the fluent begins when $x = 0$; in this case $z = 0$, and as then $s = 0$, it follows that $c = 0$; hence

$$s\ (= \text{area ODPQ}) = \tfrac{1}{2}xy + \tfrac{1}{2}az.$$

Now if we join OP, the triangle $\text{POQ} = \frac{1}{2}xy$, therefore the sector $\text{POD} = \frac{1}{2}az$.

Ex. 3. Let the curve be an ellipse, (Fig. 11.) of which the semitransverse and semiconjugate axes are a and b; suppose the origin of the co-ordinates to be at A, one extremity of the transverse. The equation of the curve is $y^2 = \frac{b^2}{a^2}(2ax - x^2)$; hence Fig. 11.

$$s = \int y\,dx = \frac{b}{a}\int dx\sqrt{(2ax - x^2)}.$$

If a circle be described on the transverse axis as a diameter, and y' be put for pQ, the ordinate of the circle, corresponding to the common abscissa x, and s' for the circular area AQp, we have $y'^2 = \sqrt{(2ax - x^2)}$, and

$$s' = \int y'\,dx = \int dx\sqrt{(2ax - x^2)}.$$

Hence, the variable parts of these two fluents have to each other the constant ratio of $\frac{b}{a}$ to 1, or of b to a, and as they begin together, the fluents themselves must have the same ratio, that is $s : s' :: b : a$, as was shewn in Conic Sections, (Sect. VII.)

Ex. 4. Let the curve be an equilateral hyperbola, (Fig. 25.) and AX, AY its asymptotes; and let it be required to find the area included by the hyperbolic arc CP, the straight lines CE, PQ, which are parallel to one asymptote, and EQ, the segment of the other asymptote, intercepted between them. Let CE, one of the parallels, have a given position. Put $\text{AE} = a$, $\text{EC} = b$, $\text{AQ} = x$, $\text{QP} = y$. By the nature of the curve $xy = ab$, hence $y = \frac{ab}{x}$, and Fig. 25.

$$s = \int y\,dx = ab\int \frac{dx}{x} = ab\,\text{l.}\,(x) + c.$$

By the nature of the problem, when $x = a$, then $s = 0$, therefore in this case, $0 = ab\,\text{l.}\,(a) + c$, hence $c = -ab\,\text{l.}\,(a)$, and

$$s = ab\left\{\text{l.}\,(x) - \text{l.}\,(a)\right\} = ab\,\text{l.}\left(\frac{x}{a}\right).$$

If we suppose $a = b = 1$, then $s = \text{l.}\left(\frac{x}{a}\right)$, hence the area s is expressed by the Napierean logarithm of the abscissa AQ, and these areas serve as a geometrical representation of Napier's logarithms. On this account they were called by the early writers *hyperbolic logarithms*, but improperly, as any logarithms whatever may be represented by hyperbolic areas. See Logarithms.

Ex. 5. Let the hyperbolic area PAQ be required, supposing PQ to be an ordinate to CA, the transverse axis (Fig. 26.) Let C, the centre, be the origin of the co-ordinates; put $\text{CQ} = x$, $\text{PQ} = y$, the semitransverse axis $= a$, the semiconjugate $= b$. The equation of the curve (Conic Sections, Sect. VIII.) is $y = \frac{b}{a}\sqrt{(x^2 - a^2)}$, hence Fig. 26.

$$s = \int y\,dx = \frac{b}{a}\int dx\sqrt{(x^2-a^2)}.$$

We may proceed with this fluent, as with that in example 2d, or else by formula (B), art. 128. which gives at once

$$\int dx\sqrt{(x^2-a^2)} = \tfrac{1}{2}x\sqrt{(x^2-a^2)} - \tfrac{1}{2}a^2\int\frac{dx}{\sqrt{(x^2-a^2)}},$$

Now, by art. 123,

$$\int\frac{dx}{\sqrt{(x^2-a^2)}} = \text{l.}\left\{x+\sqrt{(x^2-a^2)}\right\}+c.$$

Therefore,

$$s = \frac{bx}{2a}\sqrt{(x^2-a^2)} - \frac{ab}{2}\text{l.}\left\{x+\sqrt{(x^2-a^2)}\right\} - c.$$

Now, from the nature of the figure, when $x=a$, then $s=0$; therefore, in this case, the general equation becomes $0 = -\frac{ab}{2}\text{l.}(a) - c$;

hence $c = -\frac{ab}{2}\text{l.}(a)$, and

$$s = \frac{bx}{2a}\sqrt{(x^2-a^2)} - \frac{ab}{2}\text{l.}\left\{\frac{x+\sqrt{(x^2-a^2)}}{a}\right\}$$

$$\text{or } s = \tfrac{1}{2}xy - \frac{ab}{2}\text{l.}\left\{\frac{x}{a}+\frac{y}{b}\right\}$$

If we join CP, it is evident that $\frac{1}{2}xy$ expresses the area of the triangle CPQ, therefore

$$\text{Sector ACP} = \frac{ab}{2}\text{l.}\left\{\frac{x}{a}+\frac{y}{b}\right\}.$$

Fig. 12. Ex. 6. Let APD be the common cycloid, (Fig. 12.) of which AB is the axis, AHB the generating circle, having its centre on the axis, AK a perpendicular to the axis at the vertex, and PR a perpendicular to AK from P any point in the curve; and let it be required to find the external area APR.

Let O be the centre of the generating circle; draw PQ perpendicular to AB, meeting the circle in H, and join OH. Put AR $= x$, RP $= y$, AO $= a$, the angle AOH $= v$. Then AQ $= a(1-\cos. v)$, QH $= a \sin. v$, arc AH $= av$; and since, from the nature of the curve (see EPICYCLOID), PQ $=$ AR $=$ arc AH $+$ HQ, therefore

$$x = a(v+\sin. v),\ y = a(1-\cos. v),$$

$$dx = a\,dv(1+\cos. v),\ \int y\,dx = a^2\int dv(1-\cos.^2 v).$$

Now this last fluent, or $\int dv \sin.^2 v$, is found, by art. 144, to be $-\frac{1}{2}\cos. v. \sin. v. + \frac{1}{2}v$, therefore

$$s = \frac{a^2}{2}(v - \sin. v. \cos. v) + c.$$

When $v=0$, then s ought to vanish, therefore $c=0$, so that putting for v, $\sin. v$ and $\cos. v$ their values, we find

$$s = \tfrac{1}{2}\text{AO}\times\text{arc AH} - \tfrac{1}{2}\text{OQ}\times\text{QH} = \text{circ. seg. AQH}.$$

This agrees with what was shewn in the article EPICYCLOID.

Fig. 27. Ex. 7. As an example of a polar curve, let us take the spiral of Archimedes, (Fig. 27.) Let A be the pole, AC the position from which the revolving radius AP begins its motion. Put AP $= r$, the angle PAC $= v$; and let a be a given line, and $\pi = 3.14159$, &c. The nature of the curve is expressed by the equation $2\pi r = av$. Now if s denote the area AP′P, we have found (art. 72.) that in curves expressed by a polar equation, $ds = \frac{1}{2}r^2 dv$. In the present case $dv = \frac{2\pi}{a}dr$, therefore

$$s = \tfrac{1}{2}\int r^2 dv = \frac{\pi}{a}\int r^2 dr = \frac{\pi}{3a}r^3 + c.$$

If we suppose the fluent to begin when $r=0$, then $c=0$; therefore, when r has made a complete revolution, so that $v = 2\pi$, and $r = a$, the area generated will be $\frac{\pi a^2}{3} = \frac{1}{3}$ of a circle, of which a is the radius. To find the space which r passes over in the next revolution, the fluent must be taken between $v = 2\pi$, and $v = 4\pi$, that is, between $r = a$, and $r = 2a$. Corresponding to the first value of r, we have $s = \frac{\pi a^2}{3}$, and to the second $s = \frac{8\pi}{3}a^2$; the difference of these, which is the area required, is $\frac{7\pi a^2}{3}$.

151. As the area ECPQ (Fig. 14.) of any plane curve Fig. 14. is expressed by the fluent $\int y\,dx$, in which y (PQ) is some function of the abscissa x (AQ), on the other hand, every fluent $\int y\,dx$ may be represented geometrically by the area of a curve, of which x is the abscissa, and y the ordinate. The geometrical representation of a fluent shews distinctly wherein it differs from a common analytic function, such as $a + bx^n$, or a^x, or $\sin. x$, &c. These last have determinate values, corresponding to any assigned value of x, and the value of each function is altogether independent of its preceding or subsequent values. But the magnitude of the quantity expressed by the fluent $\int y\,dx$ is the increment that a certain function receives while x passes from one degree of magnitude to another.

152. The analogy between a curvilineal area and a fluent, points out a general method of approximating to the value of any fluent whatever, and to any degree of nearness. Let the fluent $\int y\,dx$ be required between the limits of $x = a$ and $x = b$. Let CPD (Fig. 28.) be Fig. 28. a curve, such, that AQ and QP, the co-ordinates which begin at a given point A, may represent x and y. In the axis AB, take AQ $= a$, the least value of x, and AQ‴ $= b$, its greatest value, and draw the ordinates PQ, P‴Q‴; then the area PQQ‴P‴ will be the geometrical expression for the fluent $\int y\,dx$, between the limits of $x = a$, and $x = b$: and by whatever means that area can be found, the same will apply to the determination of the fluent.

Let QQ‴ be divided into any number of equal parts QQ′, Q′Q″, &c. and let the ordinates P′Q′, P″Q″, &c. be drawn; these will divide the figure into the curvilineal trapeziums PP′Q′Q, P′P″Q″Q′, &c. Let a series of rectangles PQ′, P′Q″, &c. be constructed, each having the shortest of two adjoining ordinates for its height; these will fall entirely within the figure, supposing the curve to be entirely concave or convex towards the axis. Let another series P′Q, P″Q′, &c. be constructed, each having the longest of two adjoining ordinates for its height; and all these will extend beyond the figure. Because AQ $= a$, and QQ‴ $= b-a$, and the number of parts into which QQ′ is divided is known, the abscissæ AQ′, AQ″, &c. will be known, and from the nature of the curve, the corresponding ordinates P′Q′, &c. will be known. Hence we can find the inscribed rectangles PQ′, P′Q″, &c. the sum of which will be less than the curvilineal space PP‴Q‴Q; also the circumscribed rectangles P′Q, P″Q′. &c. the sum of which will exceed that space. Thus two its may be found, between which the curvilineal ce or the fluent is always contained. Besides, these its may differ by as small a quantity as we please, their difference is manifestly the rectangle PM′SR, ich is contained by PM′ = QQ′, and PR = P‴Q‴ — PQ, difference of the extreme ordinates; and QQ′ may as small as we please.

If chords PP′, P′P″, &c. be drawn, the sum of rectieal trapeziums PQQ′P′, &c. will be a nearer approxition to the area or fluent, than either the circumscrig or inscribed parallelograms. As an example of application of this method, let it be proposed to proximate to the fluent $\int \frac{dx}{1+x^2}$, between the limits $r = 0$ and $x = 1$.

In this case, the equation of the curve CD is $y = \frac{1}{+x^2}$.

Let QQ‴ be divided into ten equal parts, then, putg $x = 0$, $x = .1$, $x = .2$, &c. to $x = 1$, we obtain ven equidistant ordinates; the numeral values will as follows:

The 1st,	1.00000.	The 7th,	.73529.
The 2d,	.99010.	The 8th,	.67114.
The 3d,	.96154.	The 9th,	.60975.
The 4th,	.91743.	The 10th,	.55249.
The 5th,	.86207.	The 11th,	.50000.
The 6th,	.80000.		

By the elements of geometry, the area of the rectilil figure formed by the trapeziums, is found by add together all the ordinates except the first and last, half the sum of the first and last, and multiplying result by the common breadth of the trapeziums, ch is .1. This rule gives 7.84981 for the area or ie of $\int \frac{dx}{1+x^2}$ between the proposed limits. This nt is the arc to the tangent x, (art. 95). We have ressed it by a series, (art. 148). If in that series put $x = 1$, the fluent, between the prescribed li, will be $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} +$ &c.; but this converges slow to be of any use. The fluent ought to be 4 nearly.

53. If the ordinates PQ, P′Q′, &c. go on continualcreasing, the inscribed rectangles will be constructn the 1st, 2d, 3d, &c. ordinates, and the circumscriparallelograms on the 2d, 3d, 4th, &c. Observing, that the ordinates are the values of the function y, esponding to AQ, AQ′, &c. values of x which differ each other by the common interval QQ′, we have festly the following rule for approximating to a flu$y\,dx$, between the limits of $x = a$ and $x = b$.

t the interval between a and b be divided into n parts, each equal to h.

t Y, Y′, Y″, . . . $Y^{(n)}$, be the values of y correling to $x = a$, $x = a + h$, $x = a + 2h$, &c. to $x = a$ respectively, and let us suppose that Y, Y′, &c. continually increasing; then

$$\int y\,dx > h(Y + Y' + Y'' \ldots + Y^{(n-1)}),$$
$$\int y\,dx < h(Y' + Y'' + Y''' \ldots + Y^{(n)}).$$

e difference of these is $h(Y^{(n)} - Y)$, which, by tah sufficiently small, may be as small as we please. nay reason in a similar manner in the case in Y, Y′, Y″, &c. go on continually decreasing. Y′, &c. first increase, but afterwards decrease, terval between $x = a$ and $x = b$ may be divided into two or more portions; so that y may increase or decrease continually, from one extremity of each to the other.

Inverse Method.

Whatever be the values of y, provided they be always finite from $x = a$ to $x = b$, if Y, Y′, &c. be determined as before, we have evidently,

$$\int y\,dx = Yh + Y'h + Y''h \ldots + Y^{(n-1)}h, \text{ nearly};$$

and the smaller the increment h is, the more correct will be the approximation to the fluent; so that the number n being supposed to increase continually, and consequently h to decrease, the expression will approach continually to the fluent, which will be its *limit*.

Leibnitz, and such as have taken his view of the subject, considered the fluent $\int y\,dx$ as the *sum* of the infinitely little elements Yh, $Y'h$, &c. Hence the origin of the terms *integral*, to *integrate*, *integration*, &c. (art. 112.) And as each was the difference between two infinitely near values of the integral, regarding h as the differential of x, it followed that $y\,dx$ (the general expression for each element) was the *differential* of the integral. This manner of considering a fluent is extremely convenient, and on that account is generally employed in the application of the integral or fluxional calculus, to physics and the higher geometry.

154. We shall now make some general remarks relating to quadratures.

1. If an area s is contained between two curves CD, cd, or two branches of the same curve, (Fig. 29.), let PQ $= y$, and pQ $= y'$ be their ordinates corresponding to the common abscissa AQ $= x$, then $\int y\,dx =$ area CEQP, and $\int y'\,dx =$ area $c$EQ$p$; therefore $\int (y - y')\,dx =$ area C$cp$P.

Fig. 29.

2. Or employing the calculus of infinitesimals, we may regard the area CP$pc = s$ as made up of an infinite number of trapezoids PP′$p'p$; each having dx for its breadth, and these again as made of an infinite number of rectangles m, of which the sides are dx and dy, so that $dx\,dy$ will be an *element* of the second order of the area s: Then, to obtain s, the fluxion or differential $dx\,dy$ must be integrated from $y =$ PQ to $y = p$Q, and again the result between the limits $x =$ AQ and $x =$ AE, so that we arrive at the same final result as before.

3. The entire area of a curve that returns into itself, is found by taking the fluent of $(y - y')\,dx$ from the least to the greatest value of x.

4. The ordinate y of the curve ought never to become infinite between the limits of the area.

5. The fluxion $y\,dx$ changes its sign with y or x, hence the area becomes negative if x and y have contrary signs.

6. If a curve cuts the axis of the abscissæ between the limits of the area, the parts on each side of the axis must be found separately, because the one is positive and the other is negative, and the fluent requires to be taken without any regard to the latter sign.

For example, let KOACD be a curve of which the equation is $y = x - x^3$; (Fig. 30.) the origin of the coordinates being at A, the curve passes through A, and meets the axis in H and K, so that AH = AK = 1. The general expression for the area s is $\frac{1}{2}x^2 - \frac{1}{4}x^4 + c$. If we suppose it to begin at the point E where $x =$ AE $= \sqrt{\frac{1}{3}}$, then, at the origin of the fluent, $0 = \frac{1}{6} - \frac{1}{36} + c$; hence $c = -\frac{5}{36}$, and $s = \frac{1}{2}x^2 - \frac{1}{4}x^4 - \frac{5}{36}$. If the area is to end at F where $x =$ AF $= \sqrt{\frac{5}{3}}$, we shall find $s = 0$, which indicates that the areas ECH, HDF

Fig. 30.

[illegible] are equal but with opposite signs. In fact, putting [illegible] we find that the area [illegible] $= \frac{1}{4}$, and taking the [illegible] between the limits $x = AH = 1$ [illegible] we get the area $HDF = -\frac{1}{4}$. In like manner [illegible] taken from K to H comes out [illegible] space [illegible] below the axis is equal to [illegible]

[illegible] it is not possible to square every [illegible] to assign any number of curves [illegible] quadrable, that is, which may [illegible] algebraic functions of the [illegible] any function whatever of [illegible] we assume the ordinate $y = \frac{du}{dx}$, we have [illegible] and [illegible]. For example [illegible] then [illegible]. Hence [illegible] the coordinates x and y are so [illegible] quadrable in algebraic [illegible]. The case of [illegible] included in the formula. [illegible] curve, and the deter[illegible] a function of x of a [illegible] one another, [illegible] belonging to one and [illegible] are [illegible]. Exam[illegible]

[illegible]

[illegible] We have [illegible] that x and y being [illegible] a curve [illegible] this formula to [illegible]

[illegible]

$y = \sqrt{c^2 - x^2}$ [illegible] $\frac{-cx}{\sqrt{c^2 - x^2}}$ [illegible]

We have already given the [illegible] an infinite series, [illegible] and [illegible]. When the [illegible]

[illegible] $\frac{x}{a}$ [illegible]

$z = x + \frac{x^3}{2.3a^2} + \frac{3x^5}{2.4.5a^4} + \frac{1.3.5x^7}{2.4.6.7a^6} + \&c.$

If the arc AD be a quadrant [illegible] at D, then when $x = a$, $z = [illegible]$; [illegible] $c = 0$.

We have given a different series [illegible] for an arc, in terms of the tangent [illegible] found which shall express z by the [illegible] &c. from the formulae of art. 35. [illegible] ever can an arc be expressed by trigonometrical [illegible] in finite terms.

Ex. 4. Let the curve be an ellipse, [illegible] which the semitransverse axis $CA = 1$, [illegible] gate $CB = c$, the eccentricity, which is [illegible] Let C, the centre, be the origin of the [illegible] $CQ = x$ and $PQ = y$, and put the arc [illegible] from the extremity of the conjugate axis [illegible] the nature of the curve

$cy = \sqrt{(1 - x^2)}$, hence $dy = \frac{-c\,x\,dx}{\sqrt{(1-x^2)}}$ [illegible]

$$dz = \frac{\sqrt{\left\{1 - (1 - c^2)x^2\right\}}\,dx}{\sqrt{(1 - x^2)}} = \frac{\sqrt{(1 - [illegible]}}{\sqrt{(1 - [illegible]}}$$

The fluent of this expression cannot be found in finite terms, even with the help of circular arcs [illegible] therefore it can only be expressed by a series. By the binomial theorem, we get [illegible]

$1 - \frac{1}{2}e^2x^2 - \frac{1.1}{2.4}e^4x^4 - \frac{1.1.3}{2.4.6}e^6x^6 - \&c.$

We must now multiply each term [illegible] $\frac{dx}{\sqrt{(1 - x^2)}}$, and take the fluents, [illegible] the form [illegible] $\int \frac{x^m dx}{\sqrt{(1 - x^2)}}$, and may be [illegible]

Then, putting a for the arc whose [illegible] elliptic arc [illegible] $=$

[illegible]

suited to the case of e nearly $= 1$. Our li-
ver, oblige us to refer the reader to the fol-
ks, for farther information on this subject.
madversiones in Rectificationem Ellipseos (in
a), also *Novi Comm. Petrop.* tom. xviii. p.
dre, *Mem. de l'Acad.* 1786, p. 620, and
e Calc. Integ. Ivory, *Edin. Trans.* Vol. IV.
Edin. Trans. Vol. V. Woodhouse, *Phil.*
4.

th of a hyperbolic arc may be found exactly
manner, from its equation $c y = \sqrt{(x^2 - 1.)}$
ere is a very elegant property of elliptic arcs,
by Fagnani in 1718, (*Fag. Op.* T. II. p.
h has led to considerable improvement in the
alculus. It may be easily deduced from the
ven in art. 77, for the rectification of a curve.
be a tangent at any point D in the ellipse
Draw CE from the centre perpendicular to
nt, and parallel to it draw the semidiameter
h will be the conjugate to that drawn from C
): also, draw HK perpendicular to the axis.
mple 4, let $\text{CA} = 1$, $\text{CB} = c$, the eccentrici-
nd further, put $\text{CE} = p$, $\text{DE} = t$, the angle
$\text{HK} = \varphi$, and the elliptic arc $\text{AD} = z'$.
$\text{HK}^2 = c^2(1 - \text{CK}^2)$ and $\text{HK} = \text{CH} \times \cos.\varphi$,
$= \text{CH} \times \sin.\varphi$, therefore $\text{CH}^2 \times \cos.^2\varphi =$
$\text{H}^2 \times \sin.^2\varphi)$, and hence
$\frac{c^2}{\text{os.}^2\varphi + c^2\sin.^2\varphi}$, and putting $1 - \sin.^2\varphi$ for
d e^2 for $1 - c^2$ in the denominator,

$$\text{CH} = \frac{c}{\sqrt{(1 - e^2\sin.^2\varphi)}};$$

ce by a property of the curve, (CONIC SEC-
ect. II. Prop. 20,) $\text{CH} \times \text{CE} = \text{AC} \times \text{CB} = c$,

$\text{E} = p = \sqrt{(1 - e^2\sin.^2\varphi)}$.

since in every curve expressed by an equation
ind, (art. 77.) $d(z' + t) = p\,d\varphi$, therefore
$z' + t) = d\varphi\sqrt{(1 - e^2\sin.^2\varphi)}$. (1.)
PQ be any ordinate to the axis, then, putting
, and the arc $\text{BP} = z$, we have found (Ex. 4.
.) that $d z = \frac{d x\sqrt{(1 - e^2 x^2)}}{\sqrt{(1 - x^2)}}$: Let us now sup-
$= \sin.\varphi$, then it follows that $d x = d\varphi\cos.\varphi =$
$1 - x^2)$; we have also $1 - e^2 x^2 = 1 - e^2\sin.^2\varphi$;
e,

$d z = d\varphi\sqrt{(1 - e^2\sin.^2\varphi)}$. (2.)

formulæ (1.) and (2.) it immediately follows

$$d(z' + t) = d z, \text{ and } z' + t = z + c.$$

$p = 0$, and consequently $\sin.\varphi = x = 0$, then
d z all vanish, therefore c must be $= 0$, and we

$$z' + t = z, \qquad (3.)$$

arc AD + tan. DE = arc BP.

is in substance Fagnani's theorem. It may be
sed in words at length, thus: *Let* ADB *be an*
quadrant, draw DE *a tangent to the curve at any*
D, *and* CE *a perpendicular from the centre* C *to the*
t: As radius to the sine of the angle ACE, *so make*
CQ, *and draw the ordinate* PQ; *the arc* AD (*reck-*
rom the extremity of the transverse;) *together with*
ngent DE, *is equal to the arc* BP (*reckoned from*
tremity of the conjugate axis.) Hence it appears
ny arc of an ellipse being given, another arc may
signed *geometrically*, such, that their difference shall be equal to a certain assignable straight line; a circumstance which has been considered as remarkable. Inverse Method.

There is a corresponding theorem in the *hyperbola*; but it would extend our treatise too much to discuss this subject at greater length. On this subject, consult Fagnani, *Produzioni Mathematiche*; Euler, *Nov. Comm. Pet.* T. vi. vii. xii.; *Act. Acad. Pet.* 1778, *Pars.* ii.; *Inst. Cal. Integ.* T. i. and iii.; Lagrange, *Miscell. Tour.* T. iv.; and *Theorie des Fonct. Anal.* 2d edit. Legendre, *Exer. de Cal. Integ.* and *Mem. de l'Acad*, 1786. Landen, *Mathematical Memoirs*, vol. i.; Lacroix, *Traité du Cal. Diff. et Integ.* vol. ii. Also, Wallace, *Edin. Trans.* vol. v.; Brinkley, *Irish Trans.*; Woodhouse, *Lond. Trans.*; Ivory, in *Leybourn's Mathematical Repository*, Part ii. p. 9.

Ex. 5. If we employ the same construction and the same notation in the hyperbola, (Fig. 32.) as in the ellipse; that is, if DE be a tangent at D, and CE a perpendicular from the centre on the tangent, and if we put $\text{CA} = 1$, the eccentricity $= e$, the hyperbolic arc $\text{AD} = z$, the angle $\text{ACE} = \varphi$, the perpendicular $\text{CE} = p$, the tangent $\text{DE} = t$, we shall find exactly as in the ellipse, that $p = \sqrt{(1 - e^2\sin.^2\varphi)}$, and (art. 77) Fig. 32.

$$d(z - t) = d\varphi\sqrt{(1 - e^2\sin.^2\varphi)} \qquad (3.)$$

In the ellipse e is less than unity, but here e is greater than 1; and this circumstance makes an essential difference in the two fluxions: the one form is, however, reducible to the other, as was first shewn by Landen in *Lond. Phil. Trans.* 1775. In either case, the fluent may be found by developing $\sqrt{(1 - e^2\sin.^2\varphi)}$ into a series, then multiplying each term by $d\varphi$, and taking the fluents.

Ex. 6. Again, in the parabola (Fig. 23.) let F be the focus, A the vertex, PE a tangent at P, and FE a perpendicular to the tangent; put the parameter $= a$, the angle $\text{AFE} = \varphi$, the perpendicular $\text{FE} = p$, the tan. $\text{PE} = t$, the arc $\text{PA} = z$; we have found (art. 89. Ex. 1.) that in the parabola $p = \frac{a}{4\cos.\varphi}$, hence $d(z - t) = \frac{a\,d\varphi}{4\cos.\varphi}$, and, by art. 146. Fig. 23.

$$z - t = \frac{a}{4}\int\frac{d\varphi}{\cos.\varphi} = \frac{a}{4}\,\text{l.}\left\{\tan.\left(\tfrac{1}{4}\pi + \tfrac{1}{2}\varphi\right)\right\}$$

This fluent wants no constant quantity, because when $\varphi = 0$, both sides vanish as they ought.

From this expression we might assign parabolic arcs, which should be to each other in the given ratio of one number to another, which was first done by John Bernoulli in 1698, (Joh. Bern. *Op.* T. ii. p. 243.) See also L'Hopital, *Sect. Coniques*, page 382. This property of the parabola has some relation to Fagnani's theorems, for the ellipse and hyperbola.

Ex. 7. Let the curve be a cycloid of any kind, (Fig. 33,) of which DC is the axis, DHC a circle described on the axis, of which the radius $= 1$, PG an ordinate to the axis, which meets the circle in H. Put $\text{DG} = x$, $\text{GP} = y$, circ. arc. $\text{DH} = v$, cycloidal $\text{DP} = z$. By the nature of the curve (EPICYCLOID) $x = 1 - \cos.v$, $y = n v + \sin.v$, where n is a given number, which in the common cycloid is unity. Hence $d x = d v\sin.v$, $d y = d v(n + \cos.v)$ and Fig. 33.

$$d z = \sqrt{(d x^2 + d y^2)} = d v\sqrt{(1 + n^2 + 2 n\cos.v)}.$$

Instead of cos v, put $1 - 2\sin.^2\tfrac{1}{2}v$, and put e for $\frac{4n}{(1 + n)^2}$, and we have

$$z = (1 + n)\int dv\sqrt{(1 - e^2 \sin.^2 \tfrac{1}{2}v)}.$$

This fluent may evidently be expressed by an arc of an ellipse, also by the difference of an elliptic arc, and its tangent, (formulæ (1.) (2.) art. 158.)

Fig. 27.

Ex. 8. Let the curve be the spiral of Archimedes, (Fig. 27.) In which $AP = r$, the angle $CAP = v$, the arc $AP = z$; the equation of the curve is $2\pi r = av$, where a denotes a given line. In this case we apply the general formula $dz = \sqrt{(r^2 dv^2 + dr^2)}$, (art. 76.) and as $dv = \frac{2\pi}{a}dr$, we find

$$z = \frac{2\pi}{a}\int dr\sqrt{\left(\frac{a^2}{4\pi^2} + r^2\right)}.$$

If this expression be compared with that for a parabolic arc, (Ex. 1. art. 157.) it will appear that these curves are equal, when r is the ordinate of the parabola, and $\frac{a}{\pi}$ the parameter.

159. The early writers on fluxions endeavoured, as much as possible, to find simple geometrical representations of such fluents as could not be expressed by finite algebraic functions. They succeeded in representing such as involved the radical $\sqrt{(a + bx + cx^2)}$, which can always be made rational, by circular and hyperbolic areas; when the fluxion contained a radical of the form $\sqrt{(a + bx + cx^3 + dx^4)}$, in some cases they could express the fluent by elliptic and hyperbolic arcs, and in others by the surface of an oblique cone. Maclaurin was the first that treated at any length of this mode of expressing fluents, in his *Fluxions*, Book ii. chap. 3, and the subject was extended by D'Alembert, *Mem. de Berlin*, 1746 and 1748. Landen, in his *Memoirs* and *Lucubrations*, has arranged, in Tables, the various fluents that may be found in this manner. Lagrange and Legendre have since treated the subject in a manner purely analytical, and this last mathematician, in his *Memoire sur les Transcendantes elliptiques*, and more recently in *Exer. de Cal. In.* has reduced all fluxions, in which the only radical is $\sqrt{(a + bx + cx^2 + dx^4)}$ to three species; and he has shewn how the fluents may be expressed, by series which shall always converge rapidly.

160. As any number of curves may be found that are quadrable, so also curves may be found that are *rectifiable*. We shall now resolve this

Problem. To find algebraic curves which may be rectified, or which may have their lengths expressed by algebraic functions of the co-ordinates.

Fig. 34.

Solution. Let CPD (Fig. 34.) be a curve such as is to be found, and let AQ, QP be the co-ordinates at P, any point in the curve. Draw the tangent PE, and from A draw AE perpendicular to the tangent. Put $AQ = x$, $QP = y$, the arc $CP = z$, the perpendicular $AE = p$, the tangent $PE = t$, the angle $EAB = u$. By formula (4), art. 77, we have in every curve whatever,

$$dz = p\,du + \frac{d^2p}{du},$$

$$\text{and } z = \int p\,du + \frac{dp}{du}.$$

As z is to be an algebraic quantity, we must have $\int p\,du$ an algebraic quantity; let us suppose it $= U$, some function of u; then $p\,du = dU$, and $p = \frac{dU}{du}$: Thus the relation of p to the angle u is determined.

From E and P draw Em, Pn, perpendiculars to the co-ordinates; then observing that $PEn = EAB = u$, we have $Em = EA \times \sin. u = p \sin. u$, $Am = EA \times \cos. u = p \cos. u$, $En = EP \times \cos. u = t \cos. u$, $Pn = EP \times \sin. u = t \sin. u$; therefore, $x = p \cos. u + t \sin. u$, $y = p \sin. u - t \cos. u$. But we found (formula (A), art. 77) that $t = -\frac{dp}{du}$, therefore $t = -\frac{d^2U}{du^2}$, and

$$x = \frac{dU}{du}\cos. u - \frac{d^2U}{du^2}\sin. u, \qquad (1)$$

$$y = \frac{dU}{du}\sin. u + \frac{d^2U}{du^2}\cos. u, \qquad (2)$$

$$z = U + \frac{d^2U}{du^2}. \qquad (3)$$

These equations give a complete solution of the problem; for by the first and second we may eliminate u, and obtain an equation involving x and y only. We can also determine U and $\frac{d^2U}{du^2}$ in terms of x and y, and thence the value of z. For example, let us assume $U = 4a \sin. \frac{1}{2}u + c$, then $\frac{dU}{du} = 2a \cos. \frac{1}{2}u$, $\frac{d^2U}{du^2} = -a \sin. \frac{1}{2}u$; hence

$$x = 2a \cos. \tfrac{1}{2}u \cos. u + a \sin. \tfrac{1}{2}u \sin. u,$$
$$y = 2a \cos. \tfrac{1}{2}u \sin. u - a \sin. \tfrac{1}{2}u \cos. u,$$
$$z = 3a \sin. \tfrac{1}{2}u + c.$$

By adding the squares of the values of x and y, and putting 1 for $\cos.^2 u + \sin.^2 u$, we find

$x^2 + y^2 = a^2(4 \cos.^2 \frac{1}{2}u + \sin.^2 \frac{1}{2}u) = a^2(1 + 3 \cos.^2 \frac{1}{2}u)$, and $\frac{x^2 + y^2 - a^2}{3a^2} = \cos.^2 \frac{1}{2}u$.

And by substituting $2 \sin. \frac{1}{2}u \cos. \frac{1}{2}u$ for $\sin. u$, and $\cos.^2 \frac{1}{2}u - \sin.^2 \frac{1}{2}u$ for $\cos. u$, in the value of x, we get

$$\frac{x}{2a} = \cos.^3 \tfrac{1}{2}u.$$

From these two last equations we readily find

$$27a^4x^2 = 4(x^2 + y^2 - a^2)^3$$

for the equation of the curve, which appears to be a line of the 6th order: And as $z = 3a \sin. \frac{1}{2}u + c$, therefore, by comparing its value with that of x, it may be expressed by x. The truth of these conclusions may easily be verified by putting $\varphi = \frac{1}{2}u$, and observing that $x = \frac{3}{2}a \cos. \varphi + \frac{1}{2}a \cos. 3\varphi$, $y = \frac{3}{2}a \sin. \varphi + \frac{1}{2}a \sin. 3\varphi$, $z = 3a \sin. \varphi + c$.

Huygens resolved this problem by his theory of evolute curves (*Horologium Oscillatorium*, Pars III.) and Newton gave a solution upon principles deduced from the same theory, (*Method of Fluxions*, Prob. 10.) It also engaged the attention of Euler, (*Nov. Comm. Acad. Petrop.* T. v.); and Lagrange has given a solution, upon principles purely analytical, in his *Calcul. des Fonctions Leçon* 19. The solution given here agrees with his in the result, but it has been obtained in a different manner.

Of the Content of Solids.

161. Let A–PEp (Fig. 19.) be any solid formed by the revolution of a plane curve about its axis AB, then if $AQ = x$, and $PQ = y$, be the co-ordinates of P, any point in the curve, and s the content of the solid, it follows, from art. 79. that

$$s = \pi\int y^2 dx.$$

We shall now apply this formula to some examples.

Inverse Method.

Example 1. Let the generating curve be a parabola, which revolves about its axis. By the nature of the curve, $y^2 = a x$, therefore in this case

$$s = \pi \int a x\, d x = \tfrac{1}{2} \pi a x^2 + c = \tfrac{1}{2} \pi y^2 x + c.$$

If we suppose the fluent to begin when $x = 0$, then $c = 0$; and as πy^2 expresses the area of the base, it appears that the content of a paraboloid is half a cylinder of the same base and altitude.

Fig. 35. Ex. 2. Suppose the solid to be a parabolic spindle (Fig. 35.), which is generated by the revolution of a parabolic arc ADB about AC, an ordinate to the axis. From P, any point in the revolving curve, draw PQ perpendicular to the ordinate AC, and PR perpendicular to the axis of the parabola; put $DC = p$, $AC = q$, $CQ = PR = x$, $PQ = CR = y$. By the nature of the curve, $PR^2 : AC^2 :: DR : DC$ (Conic Sections, Sect. IV. Prop. 13.), that is, $x^2 : q^2 :: p - y : p$, hence $p x^2 = p q^2 - q^2 y$, and

$$y^2 = \frac{p^2}{q^4} (q^4 - 2 q^2 x^2 + x^4),$$

$$\text{and } s = \frac{p^2 \pi}{q^4} \int (q^4\, d x - 2 q^2 x^2\, d x + x^4\, d x),$$

and taking the fluents of the several terms,

$$s = \frac{p^2 \pi}{q^4} (q^4 x - \tfrac{2}{3} q^2 x^3 + \tfrac{1}{5} x^5) + c.$$

If the fluent commence when $x = 0$, then $c = 0$: And making $x = q$, we get $\frac{8}{15} p^2 q \pi$ for half the content of the solid generated by the curve ADB.

ig. 36. Ex. 3. Let the solid be a spheroid APB, (Fig. 36.) produced by the revolution of an ellipse about AB, either of the axes. Put the fixed axis $AB = a$, the revolving axis $DE = b$, also $AQ = x$, $QP = y$. From the nature of the ellipse, $y^2 = \frac{b^2}{a^2} (a x - x^2)$, hence

$$s = \frac{\pi b^2}{a^2} \int (a x - x^2)\, d x = \frac{\pi b^2}{a^2} (\tfrac{1}{2} a x^2 - \tfrac{1}{3} x^3) + c.$$

If the fluent begin when $x = 0$, then $c = 0$. By making $x = a$, we get $\frac{1}{6} \pi b^2 a$ for the content of the whole spheroid; and supposing $a = b$, we have $\frac{1}{6} \pi a^3$ for the content of a sphere, whose diameter is a; and as $\frac{1}{4} \pi b^2$ is the area of a section of the sphere or spheroid through the centre, it appears that the whole solid is $\frac{2}{3}$ of the circumscribing cylinder; which is the well-known theorem of Archimedes.

In the same manner we may find the content of a hyperboloid.

19. 162. If the solid APE (Fig. 19.) is not formed by the revolution of a curve about a fixed axis; yet, if it can be referred to an axis AB, so that PEp, any section of the solid by a plane perpendicular to that axis, is some known function of $AQ = x$, the segment of the axis between the plane and a given point A, its content may be found from the very same formula. For it may be proved exactly, as in art. 79, that a ratio of equality is the limit of the ratio of the increment of the solid to a cylinder, whose base is a section of the solid, and altitude the increment of the axis; so that if s denote the solid, and X denote the area of the section PEp, we have *limit* $\frac{\text{incr. } s}{\text{incr. } x} = \text{X}$, and $\frac{d s}{d x} = \text{X}$, and $s = \int \text{X}\, d x$.

7. Ex. 1. Let P′E′p' (Fig. 37.) be any plane figure whatever, and A a given point out of its plane: It is required to find the content of the conical solid formed by a straight line, which, passing through A, is carried round in the circumference of the figure P′E′p'.

Let AQB, a perpendicular to the base of the solid, meet PEp, a section parallel to the base in Q. Put the area of the base $= b$, the perpendicular $AB = p$, and let x and X denote as above. The section of any cone whatever, by a plane parallel to its base, being always similar to the base, we have $p^2 : x^2 :: b : \text{X}$, hence $\text{X} = \frac{b x^2}{p^2}$, and

$$s = \int \text{X}\, d x = \frac{b}{p^2} \int x^2\, d x = \frac{b x^3}{3 p^2}.$$

Here no correction is wanted, because when $x = 0$, then $s = 0$; and putting X instead of $\frac{b x^2}{p^2}$, we have $s = \frac{1}{3} \text{X} x$, but X x is the content of a cylinder whose base is X, and altitude x; therefore every solid of this kind is one-third of a cylinder of the same base and altitude. This rule applies to cones and pyramids, whose bases are any figures whatever.

Ex. 2. Let the solid be what is called a Groin (Fig. 38.), which is generated by a variable square $c e f g$ moving parallel to itself, the section DAH, through the middle of the opposite sides, being a semicircle. Draw AB perpendicular to the plane of the base, put $AB = p$, $AQ = x$, $PQ = y$; then $y^2 = 2 p x - x^2$ by the nature of the circle, but $4 y^2$ is the area of the section $c e f g = \text{X}$, hence Fig. 38.

$$s = \int \text{X}\, d x = \int (8 p x\, d x - 4 x^2\, d x) = 4 p x^2 - \frac{4 x^3}{3}.$$

Here no correction is wanted, because if $x = 0$, then $s = 0$. When $x = p$, then $s = \frac{8}{3} p^3$, the content of the whole solid.

Of the Surfaces of Solids.

Of the surfaces of solids. Fig. 20.

163. In Fig. 20, let AB be the axis of a solid of revolution, and AP the generating curve; put $AQ = x$, $PQ = y$, the arc $AP = z$, and the surface generated by the curve $AP = v$. The general formula is in this case (art. 80.)

$$v = 2 \pi \int y \sqrt{(d x^2 + d y^2)} = 2 \pi \int y\, d z.$$

We shall now apply this to some examples.

Example 1. Let the solid be a sphere, of which the axis is AB (Fig. 36.), and let it be required to find the surface of the segment, cut off by a plane PEp perpendicular to the axis. Put the radius of the sphere $= a$, AQ the height of the segment $= x$; the radius of its base $PQ = y$; by the nature of the figure, $y^2 = 2 a x - x^2$, hence $y\, d y = (a - x)\, d x$, and $d y = \frac{(a - x)\, d x}{y}$, Fig. 36.

$$\text{and } d x^2 + d y^2 = \frac{y^2 + (a - x)^2}{y^2}\, d x^2 = \frac{a^2\, d x^2}{y^2};$$

$$\text{hence, } d v = 2 \pi y \sqrt{(d x^2 + d y^2)} = 2 \pi a\, d x,$$
$$\text{and } v = 2 \pi a x.$$

Here no correction is wanted, because we have supposed that when $x = 0$, then $s = 0$. Since $2 \pi a$ is the circumference of a great circle of the sphere, it appears, that the curve surface of any segment of a sphere is equal to a rectangle contained by the height of the segment, and a straight line equal to the circumference of a great circle of the sphere. From which it appears, that the whole surface of the sphere is four times the

Inverse Method.

Divide by $a x + b y$, and put $z x$ instead of y, and the equation becomes

$$dy + \frac{f+gz}{a+bz}dx = 0;$$

instead of dy put now $z dx + x dz$, and the equation is transformed to

$$\frac{dx}{x} + \frac{(a+bz)dz}{bz^2+(a+g)z+f} = 0.$$

The fluents of the two parts of this equation may now easily be found. As a particular case, let $y dy + (x+2y)dx = 0$; then, because $a=0$, $b=f=1$, $g=2$, we have $\frac{dx}{x} + \frac{z dz}{z^2+2z+1} = 0$. This is easily transformed to

$$\frac{dx}{x} + \frac{dz}{1+z} - \frac{dz}{(1+z)^2} = 0,$$

and hence, taking the fluents,

$$\text{l.}(cx) + \text{l.}(1+z) + \frac{1}{1+z} = 0.$$

or $\text{l.}\left\{c(x+xz)\right\} = -\frac{1}{1+z}$, and putting y for xz,

$$\text{l.}\left\{c(x+y)\right\} + \frac{x}{x+y} = 0.$$

Ex. 2. Let $a y^m dy + (x^m + b y^m)dx = 0$; hence we have

$$dy + \frac{1+bz^m}{az^m}dx = 0, \text{ and } \frac{dx}{x} + \frac{az^m dz}{az^{m+1}+bz^m+1} = 0.$$

Here the variable quantities being separated, the fluents may be found as usual.

Ex. 3. Let $x dy - y dx = dx\sqrt{(x^2+y^2)}$; we divide by x, and have $dy - \frac{y}{x}dx = dx\sqrt{\left(1+\frac{y^2}{x^2}\right)}$: And making $y = xz$, so that $dy = z dx + x dz$, we have

$$\frac{dx}{x} = \frac{dz}{\sqrt{(1+z^2)}},$$

hence (art. 123.) $x = cz + c\sqrt{(1+z^2)}$, or $x^2 = cy + c\sqrt{(x^2+y^2)}$, which, by transposing cy, and taking the squares, becomes $x^2 = 2cy + c^2$.

170. In some cases an equation may be rendered homogeneous by transformation. Thus, in the equation

$$(ax+by+e)dy + (mx+ny+p)dx = 0,$$

we make $(ax+by+e) = z$, $mx+ny+p = t$,
hence $a dx + b dy = dz$, $m dx + n dy = dt$,
and $dy = \frac{m dz - a dt}{mb - na}$, $dx = \frac{b dt - n dz}{mb - na}$.

The proposed equation now becomes $z dy + t dx = 0$, or $(mz - nt)dz + (bt - az)dt = 0$, which is homogeneous.

If $mb - na = 0$, this transformation fails; but then, $m = \frac{na}{b}$, and the proposed equation is

$$be\,dy + bp\,dx + (ax+by)(b\,dy + n\,dx) = 0,$$

the variable quantities may now be separated by making $ax + by = z$, by which $dy = \frac{dz - a dx}{b}$. The equation then becomes

$$dx = \frac{(e+z)dz}{ae - bp + (a-n)z},$$

171. Let us now consider the equation

$$dy + Py\,dx = Q\,dx,$$

Inverse Method.

in which P and Q are functions of x alone. This equation has been called *linear*, but with more propriety, a fluxional equation of the *first degree*, and of the first order. We make $y = zt$; by this substitution the equation becomes

$$z dt + t dz + Pzt\,dx = Q\,dx;$$

as we may make any assumption we please respecting one of the indeterminate quantities z, t, we may suppose that the coefficient of z is $=0$; by this we get

$$dt + Pt\,dx = 0,\ t\,dz = Q\,dx.$$

The first equation gives $\frac{dt}{t} = -P\,dx$, and hence $\text{l.}(t) = -\int P\,dx$; and as $P\,dx$ does not contain y, its fluent may always be found. Let us denote it by u, then we have $\text{l.}(t) = -u + a$, (a being a constant quantity) and $t = e^{-u+a} = e^{-u}e^{a}, = Ae^{-u}$; here e is the number of which Nap. log. $=1$, and A is put for the constant quantity e^{a}. We now substitute this value of t in the equation $t\,dz = Q\,dx$, and we have $A\,dz = Qe^{u}dx$, and hence

$$Az = \int Qe^{u}dx + c.$$

Now Q and u are known functions of x, and the fluent $\int Qe^{u}dx$ being found, we put for A z its value $\frac{Ay}{t}$, or ye^{u}, and at last we find

$$ye^{u} = \int Qe^{u}dx + c, \text{ where } u = \int P\,dx.$$

From this expression we may infer that it was not necessary to add the constant quantity a to the fluent $\int P\,dx = u$, as it has disappeared again in the subsequent part of the calculus.

EXAMPLE. Let the equation be $dy + y\,dx = ax^3dx$; then $P = 1$, $Q = ax^3$, $u = \int P\,dx = x$,

$$\int Qe^{u}dx = \int ax^3e^{x}dx = ae^{x}(x^3 - 3x^2 + 6x - 6),$$

therefore $y = ce^{-x} + a(x^3 - 3x^2 + 6x - 6)$.

172. The early analysts classed fluxional equations by the number of their terms. In such as consisted of two terms, and which therefore had the form $\beta u^g z^h dz = \alpha u^e z^f du$, the variable quantities could be immediately separated; it was not so however of equations consisting of three terms comprehended in the formula

$$\gamma u^i z^k dz + \beta u^g z^h du \quad \alpha u^e z^f du.$$

This may be put under a more simple form by dividing all the terms by $\gamma u^i z^f$, it then becomes

$$z^{k-f}dz + \frac{\beta}{\gamma}u^{g-i}z^{h-f}du = \frac{\alpha}{\gamma}u^{e-i}du.$$

Suppose now $z^{k-f}dz = \frac{dy}{k-f+1} du^{g-i}du = \frac{dx}{g-i+1}$, then, $z^{k-f+1} = y$, $u^{g-i+1} = x$, and

$$dy + \frac{(k-f+1)\beta}{(g-i+1)\gamma}y^{\frac{h-f}{k-f+1}}dx$$

$$= \frac{(k-f+i)\alpha}{(g-i+1)\gamma}x^{\frac{e-g}{g-i+1}}dx;$$

In order to abridge, make

$$\frac{(k-f+1)\beta}{(g-i+1)\gamma} = b,\ \frac{(k-f+1)\alpha}{(g-i+1)\gamma} = a,$$

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$$\frac{k-f}{k-f+1}=n,\ \frac{e-g}{g-i+1}=m;$$

and then the equation will become

$$dy+by^n\,dx=ax^m\,dx.$$

When $n=1$, the equation belongs to the class we have considered in last article. When $n=2$, the equation becomes

$$dy+by^2\,dx=ax^m\,dx.$$

James Bernoulli was the first that considered this equation; he gave an approximate solution of it, which, however, did not appear until the year 1744, almost forty years after his death. In 1720, the Count Riccati having succeeded in separating the variable quantities in an extensive class of particular cases, he proposed it to the consideration of geometers. (*Supp. to Leip. Acts*, t. viii. p. 73,) and soon after Nicolas Bernoulli, the son of James; Daniel Bernoulli, and his brother Nicolas, Euler and Goldbatch, found several solutions analogous to that of Riccati. When $m=0$, in which case the equation is $dy+by^2\,dx=a\,dx$, the variable quantities may be separated, for we have then

$$dx=\frac{dy}{a-by^2}.$$

Proceeding from this case, geometers have succeeded in separating the variable quantities when m is any number of the form $\frac{-4i}{2i\pm1}$, i being supposed any integer number. The general problem, however, remains unresolved, and indeed its solution is as much a *desideratum* among analysts as the quadrature of the circle was among the geometers of ancient times. On Riccati's equation, see Euler *Inst. Cal. Integ.* vol. i. sect. 2. cap. 1. Lacroix, *Traité du Cal. Dif.* vol. ii. p. 256, &c.

If the separation of the variable quantities generally be a problem of insurmountable difficulty, in so simple a case of an equation of three terms, its solution is much less to be expected, generally, in an equation of four or more terms. In some cases, by employing happy substitutions, the thing may be done, but these cannot be reduced to general rules.

173. When the expression which constitutes a fluxional equation is such as would result immediately by taking the fluxion of some function of x and y, then that function put equal to a constant quantity will be the primitive equation. The fluxional equation $xdy+y\,dx=0$ is of this nature; its first member is the fluxion of the product xy, therefore $xy=c$ is the primitive equation.

A fluxional equation, however, may not be the result immediately found by taking the fluxion of the primitive. It may be formed by the elimination of some constant quantity contained in the primitive and its fluxional equation, or else it may be the result left after the fluxion of the primitive has been divided by some factor common to all its terms. Thus, if the primitive be $y=cx$, or $y-cx=0$, then the fluxional equation is $dy-c\,dx=0$; here the terms of the equation, as in the other case, form an exact fluxion whose fluent is $y-cx$; if, however, by means of the two equations $y-cx=0$, and $dy-c\,dx=0$, we eliminate c, we get $x\,dy-y\,dx=0$. The same result will be obtained, if we put the primitive equation under this form $\frac{y}{x}-c=0$, for then $\frac{x\,dy-y\,dx}{x^2}=0$, and, rejecting the common factor $\frac{1}{x^2}$, $x\,dy-y\,dx=0$. This expression $x\,dy-y\,dx$ is not an exact fluxion, but it may be rendered so, by restoring the factor $\frac{1}{x^2}$, for then it becomes $\frac{x\,dy-y\,dx}{x^2}$, the fluxion of $\frac{y}{x}$.

174. In general, let u be any function of two variable quantities x and y, then, whether these be regarded as independent of each other, or the one as a function of the other, we have $du=\frac{du}{dx}dx+\frac{du}{dy}dy$ (art. 103.) in this expression $\frac{du}{dx}$, means the fluxional coefficient of the function u, taken as if x were the only variable quantity contained in the function, y being of course considered as constant; and $\frac{du}{dy}$ is to be understood in a similar sense in regard to x (art. 100.) Put $\frac{du}{dx}=\mathrm{M}$, $\frac{du}{dy}=\mathrm{N}$, then, $du=\mathrm{M}\,dx+\mathrm{N}\,dy$; now, it has been proved (art. 102.) that $\frac{d^2u}{dy\,dx}=\frac{d^2u}{dx\,dy}$, therefore

$$\frac{d\mathrm{M}}{dy}=\frac{d\mathrm{N}}{dx}. \qquad (1)$$

Hence we may conclude, *that if* M *and* N *are such functions of two variable quantities* x *and* y *that* M d x + N d y *is a complete fluxion, the condition expressed by the equation* (1) *will always be satisfied.*

On the contrary, *if* M *and* N *are such functions of* x *and* y, *that* $\frac{d\mathrm{M}}{d\mathrm{y}}=\frac{d\mathrm{N}}{d\mathrm{x}}$, *then* M d x + N d y *shall be an exact fluxion, which may in every case be found.*

To prove the second part of the proposition, let us suppose the fluent of $\mathrm{M}dx$ to be taken upon the hypothesis, that in the function M, x is variable, and y constant; and let the fluent be P + Y, where Y is any function whatever of y, which serves as the constant correction of the fluent, and P is a known function of x and y, which results from $\int\mathrm{M}\,dx$ relatively to x only, so that $\mathrm{M}=\frac{d\mathrm{P}}{dx}$. The complete fluxion of P + Y is $\frac{d\mathrm{P}}{dx}dx+\frac{d\mathrm{P}}{dy}dy+d\mathrm{Y}$ (103.) or $\mathrm{M}dx+\frac{d\mathrm{P}}{dy}dy+d\mathrm{Y}$; by comparing this with $\mathrm{M}dx+\mathrm{N}dy$, we see that the two expressions will be identical, if we can give such a value to Y, that $\mathrm{N}dy=\frac{d\mathrm{P}}{dy}dy+d\mathrm{Y}$, or

$$d\mathrm{Y}=\left(\mathrm{N}-\frac{d\mathrm{P}}{dy}\right)dy; \qquad (2.)$$

and then the fluent of $\mathrm{M}dx+\mathrm{N}dy$ will be P + Y.

Now, by taking the fluxion of $\mathrm{M}=\frac{d\mathrm{P}}{dx}$ in respect of y, we have $\frac{d\mathrm{M}}{dy}=\frac{d^2\mathrm{P}}{dy\,dx}$, but by hypothesis $\frac{d\mathrm{M}}{dy}=\frac{d\mathrm{N}}{dx}$, and $\frac{d^2\mathrm{P}}{dy\,dx}=\frac{d^2\mathrm{P}}{dx\,dy}$ (102.), therefore $\frac{d\mathrm{N}}{dx}=\frac{d^2\mathrm{P}}{dx\,dy}$, and $\frac{d\mathrm{N}}{dx}-\frac{d^2\mathrm{P}}{dx\,dy}=0$; that is $d\left(\mathrm{N}-\frac{d\mathrm{P}}{dy}\right)=0$, the fluxion being taken, supposing x alone variable; therefore $\mathrm{N}-\frac{d\mathrm{P}}{dy}$ is constant in respect of x, so that it is a function of y only; hence the possibility of finding $\mathrm{Y}=\int\left(\mathrm{N}-\frac{d\mathrm{P}}{dy}\right)dy$ is proved, and we have the

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fluent of $M\,dx + N\,dy$ expressed by $P + \int\left(N - \frac{dP}{dy}\right)dy$, and here, $P = \int M\,dx$, the fluent being taken upon the supposition that y is constant.

It is evident that we may begin with taking the fluent of $N\,dy$, supposing that x is constant, and proceed in all respects as we have explained above. In general, we ought to begin with that term which brings out the fluent with the least calculation.

EXAMPLE 1. Let $2\,b\,x\,dx + \frac{dy}{\sqrt{(1+y^2)}} + a\,dy = 0$.

In this case $M = 2\,b\,x$, $N = \frac{1}{\sqrt{(1+y^2)}} + a$, and $\frac{dM}{dy} = 0$, $\frac{dN}{dx} = 0$; as the condition expressed by the equation (1.) is satisfied, the expression $2\,b\,x\,dx + \frac{dy}{\sqrt{(1+y^2)}} + a\,dy$ is an exact fluxion. To determine the fluent, we have $P = \int M\,dx = b\,x^2$, $\frac{dP}{dy} = 0$,

$$\int\left(N - \frac{dP}{dy}\right)dy = \int\left(a\,dy + \frac{dy}{\sqrt{(1+y^2)}}\right)$$
$$= a\,y + \text{l.}\left\{cy + c\sqrt{(1+y^2)}\right\}.$$

Hence the primitive equation is

$$b\,x^2 + a\,y + \text{l.}\left\{cy + c\sqrt{(1+y^2)}\right\} = 0.$$

Ex. 2. Let the fluxional equation be

$$\frac{a(x\,dx + y\,dy)}{\sqrt{(x^2+y^2)}} + \frac{y\,dx - x\,dy}{x^2+y^2} + 3\,b\,y^2\,dy = 0;$$

in this case $M = \frac{a\,x}{\sqrt{(x^2+y^2)}} + \frac{y}{x^2+y^2}$,

$$N = \frac{a\,y}{\sqrt{(x^2+y^2)}} - \frac{x}{x^2+y^2} + 3\,b\,y^2.$$

These expressions for M and N satisfy the condition $\frac{dM}{dy} = \frac{dN}{dx}$, (we omit the calculation for the sake of brevity,) therefore the expression which is put $= 0$, is an exact fluxion; to determine it, we have

$$P = \int\frac{a\,x\,dx}{\sqrt{(x^2+y^2)}} + \int\frac{y\,dx}{x^2+y^2}$$
$$= a\sqrt{(x^2+y^2)} + \text{arc.}\left(\text{tan.}\,\frac{x}{y}\right),$$

the fluents being taken upon the hypothesis that y is constant,

$$\frac{dP}{dy} = \frac{a\,y}{\sqrt{(x^2+y^2)}} - \frac{x}{x^2+y^2},\quad N - \frac{dP}{dy} = 3\,b\,y^2,$$
$$\int\left(N - \frac{dP}{dy}\right)dy = \int 3\,b\,y^2\,dy = b\,y^3 + c.$$

The fluent is therefore

$$a\sqrt{(x^2+y^2)} + \text{arc}\left(\text{tan.}\,\frac{x}{y}\right) + b\,y^3 + c = 0.$$

Ex. 3. Let the fluxional equation be

$$\frac{y\,dy}{\sqrt{(x^2+y^2)}} + dx\left\{1 + \frac{x}{\sqrt{(x^2+y^2)}}\right\} = 0;$$

Here $N = \frac{y}{\sqrt{(x^2+y^2)}}$, $M = 1 + \frac{x}{\sqrt{(x^2+y^2)}}$,

$$\frac{dM}{dy} = \frac{-xy}{(x^2+y^2)^{\frac{3}{2}}},\quad \frac{dN}{dx} = \frac{-xy}{(x^2+y^2)^{\frac{3}{2}}}.$$

Hence it appears that the first member of the equation is an exact fluxion, and, proceeding as in last example, we find

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$$x + \sqrt{(x^2+y^2)} = c.$$

175. If, in the equation $M\,dx + N\,dy = 0$, the condition $\frac{dM}{dy} = \frac{dN}{dx}$, (which is called the condition of integrability,) is not satisfied, we may next inquire whether it be possible to find some factor, a function of x and y, by which, when the expression $M\,dx + N\,dy$ is multiplied, it may become a complete fluxion. Let the fluxional equation be put under this form $\frac{dy}{dx} + K = 0$, K being equivalent to $\frac{M}{N}$. This equation results from the elimination of a constant quantity c between a primitive equation, which may be expressed thus, $f(x, y, c) = 0$, and its immediate fluxion. Or else c may be eliminated directly, by bringing the primitive equation to the form $F(x, y) = c$, which will lead to the same result, (see Example in article 49.) Put u for $F(x, y)$, also $P\,dx$ for the fluxion of u taken relatively to x, and $Q\,dy$ for its fluxion relatively to y; so that $du = P\,dx + Q\,dy$ and $\frac{du}{dx} = P + Q\frac{dy}{dx} = 0$; hence $\frac{dy}{dx} + \frac{P}{Q} = 0$. Because this equation does not contain c, it ought to be identical with the equation $\frac{dy}{dx} + K = 0$; therefore

$$\frac{dy}{dx} + K = \frac{dy}{dx} + \frac{P}{Q} = \frac{P\,dx + Q\,dy}{Q\,dx},$$

that is, $\frac{dy}{dx} + K = \frac{du}{Q\,dx}$; and hence

$$Q\,(dy + K\,dx) = du.$$

Now, the second member is a complete fluxion, therefore the first member is also a complete fluxion; hence it appears, *that there always exists a factor* Q, *by which, if the fluxional equation* d y + K d x = 0 *be multiplied, the result will be a complete fluxion.*

Let both sides of this last equation be multiplied by U, any function whatever of u, then we have

$$UQ\,(dy + K\,dx) = U\,du.$$

Now, $U\,du$ is still a complete fluxion; therefore the other member of the equation will also be a complete fluxion; and as the factor UQ may have an infinite variety of forms, it appears that *there is an infinite number of factors, such, that if a fluxional equation be multiplied by any one of them, it will be rendered a complete fluxion.*

176. It appears now, that the whole difficulty of resolving a fluxional equation is reduced to the determination of a factor which may render it integrable. This, however, in general, is a problem of insuperable difficulty. It can be resolved when the equation is homogeneous, and also when it has the form $dy + P\,y\,dx = Q\,dx$, P and Q being any functions of x; but we have seen, that in these cases a solution may be obtained by other means. When the primitive equation is known, the factor can be found by which the primitive might have been deduced from its fluxional equation; but then it is of no use. Euler, after having shewn that, in certain cases, the factor may be found, inverts the problem, and inquires what fluxional equations may be rendered integrable by factors of a given form. On this subject we must refer to his *Instit. Cal. Int.* vol. i. sect. 2., or Lacroix, *Traite du Cal. Dif.* &c. 2d part, chap. 4.

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177. Let M be any function of two quantities x, y, and let $u=\int M\,dx$, the fluent being supposed taken upon the hypothesis that x is variable and y constant; it is sometimes necessary to find the fluxional co-efficient of u relatively to y, or in other words, to find the fluxion of $\int M\,dx$ relatively to y, without previously finding the fluent of the expression in respect of x. Because $u=\int M\,dx$, therefore $\frac{du}{dx}=M$, $\frac{d^2u}{dy\,dx}=\frac{dM}{dy}$, but $\frac{d^2u}{dy\,dx}=\frac{d^2u}{dx\,dy}$, therefore $\frac{d^2u}{dx\,dy}=\frac{dM}{dy}$, and $\frac{d^2u}{dx\,dy}\,dx=\frac{dM}{dy}\,dx$, and taking the fluent relatively to x, considering now y as constant, $\frac{du}{dy}=\int\frac{dM}{dy}\,dx$.

Ex. Let $u=\int\frac{y\,dx}{\sqrt{(y^2-x^2)}}$, here $M=\frac{y}{\sqrt{(y^2-x^2)}}$, and $\frac{dM}{dy}=\frac{-x^2}{(y^2-x^2)^{\frac{3}{2}}}$ and $\frac{du}{dy}=\int\frac{-x^2\,dx}{(y^2-x^2)^{\frac{3}{2}}}$.

The theorem expressed by the formula $\frac{du}{dy}=\int\frac{dM}{dy}\,dx$ will apply to the calculation of $\frac{dP}{dy}$, in art. 174, without previously taking the fluent $P=\int M\,dx$. It was invented by Leibnitz, and was considered as an important discovery in the calculus. (See Bossut *Traité du Cal. Diff.* &c. vol. ii. p. 58.) The whole fluxion of u relatively to both x and y will be

$$M\,dx+\left\{\int\frac{dM}{dy}\,dx\right\}dy.$$

Observing that the fluent in the parenthesis is to be taken, supposing x alone to be variable.

178. When a fluxional equation involves the second or higher powers of dx and dy, as in this example $dy^2-a^2dx^2=0$, we may find the value of $\frac{dy}{dx}$, by resolving an algebraic equation. In the present case, $\frac{dy}{dx}=\pm a$, so that $dy+a\,dx=0$, and also $dy-a\,dx=0$; hence $y+ax+c=0$, and $y-ax+c'=0$, are two primitive equations, from either of which the fluxional equation may be derived, and also from their product

$$(y+ax+c)\,(y-ax+c')=0.$$

179. When the equation contains only one of the variable quantities, x for example, we may deduce from it $\frac{dy}{dx}=X$, a function of x; and hence $y=\int X\,dx$. But if it be more easy to resolve the equation in respect of x, then, putting $\frac{dy}{dx}=p$, we may find $x=P$; some function of p, and hence $dx=d\,P$; and since $dy=p\,dx$, therefore, $dy=p\,dP$, and $y=\int p\,dP=p\,P-\int P\,dp$. The relation between x and y is now to be found by eliminating p, by means of the two equations

$$x=P,\ y=p\,P-\int P\,dp.$$

Let the equation be $x\,dx+a\,dy=b\sqrt{(dx^2+dy^2)}$; Making $p=\frac{dy}{dx}$, we have

$$x=b\sqrt{(1+p^2)}-ap=P,$$
$$y=bp\sqrt{(1+p^2)}-\tfrac{1}{2}ap^2-b\int dp\sqrt{(1+p^2)}.$$

The fluent of $dp\sqrt{(1+p^2)}$ may be found by art. 123.

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180. When the primitive equation cannot be deduced from a fluxional equation by any of the known artifices of analysis, then, as a last resource, recourse must be had to approximation by infinite series.

Ex. Let the fluxional equation be $dy+y\,dx=mx^n\,dx$, and let us suppose it to be known that when $x=a$, then $y=b$. Assume $x=a+t$, and $y=b+u$; then when $t=0$ we have $u=0$; we have also $dx=dt$ and $dy=du$; by these, the proposed equation is transformed to

$$du+(b+u)\,dt=m(a+t)^n\,dt.$$

We next assume

$$u=At^{\alpha}+Bt^{\alpha+1}+Ct^{\alpha+2}+\text{\&c.}$$

α, A, B, C, &c. being indeterminate quantities which are to be investigated. From this assumption, $du=$

$$\left\{\alpha At^{\alpha-1}+(\alpha+1)Bt^{\alpha}+(\alpha+2)Ct^{\alpha+1}+\text{\&c.}\right\}dt.$$

The terms of the equation being now brought all to one side and put $=0$, and these expressions for u and du being substituted in it, we have

$$\left.\begin{array}{l}\alpha At^{\alpha-1}+(\alpha+1)Bt^{\alpha}+(\alpha+2)Ct^{\alpha+1}+\text{\&c.}\\ +b\quad+\qquad At^{\alpha}+\qquad Bt^{\alpha+1}+\text{\&c.}\\ -ma^n-m\frac{n}{1}a^{n-1}t-m\frac{n(n-1)}{1\,.\,2}a^{n-2}t^2-\text{\&c.}\end{array}\right\}=0.$$

If we suppose $\alpha=1$, the terms placed vertically become similar, and then putting the coefficients of like powers of $t=0$ agreeably to the theory of indeterminate coefficients, there results

$$A+b-ma^n=0,\ 2B+A-mna^{n-1}=0,$$
$$3C+B-m\frac{n(n-1)}{1\,.\,2}a^{n-2}=0,\ \text{\&c.}$$

Hence $A=ma^n-b$,

$$B=\frac{mna^{n-1}-ma^n+b}{2},$$
$$C=\frac{mn(n-1)a^{n-2}-mna^{n-1}+ma^n-b}{2\,.\,3},$$

&c.

These values being substituted in the series, we have u expressed by t and known quantities; we may then put $x-a$ for t, and $y-b$ for u, and the result will give the relation between x and y.

We might have proceeded with the original equation $dy+y\,dx=mx^n\,dx$ exactly as we have done with the transformed equation, assuming $y=Ax^{\alpha}+Bx^{\alpha+1}+$&c. But as the result would not have contained a constant correction, it would only have given the relation of y and x upon the hypothesis that $y=0$, when $x=0$. The transformation serves to introduce the constant correction.

181. In the assumed series $u=At^{\alpha}+Bt^{\alpha+1}+$ &c. the exponents of t form an arithmetical progression, of which the common difference is 1. In many cases, however, the common difference will be a fraction, as in this example $(dx+dy)\,y=dx$; here we may assume

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$$y = A x_a + B x_b + C x_c + \&c.$$

By proceeding as before, we find

$$\left.\begin{array}{llll} A^2 a x^{2a-1} & + AB a x^{a+b-1} & + AC a x^{a+c-1} & + \&c. \\ & + AB b x^{a+b-1} + & B^2 b x^{2b-1} & + \&c. \\ & & + AC c x^{a+c-1} & + \&c. \\ -1 & + A x^{a} & + B x^{b} & + \&c. \end{array}\right\} = 0.$$

Hence $2a - 1 = 0$, $a + b - 1 = a$, $a + c - 1 = b$, &c.
Therefore $a = \frac{1}{2}$, $b = 1$, $c = \frac{3}{2}$, &c.
Again, $A^2 a = 1$, $AB(a + b) + A = 0$, &c.
Hence $A = \sqrt{2}$, $B = -\frac{2}{3}$, $C = \frac{1}{18}\sqrt{2}$, &c.
and $y = x^{\frac{1}{2}}\sqrt{2} - \frac{2}{3} x^{\frac{2}{2}} + \frac{1}{18} x^{\frac{3}{2}}\sqrt{2} - \&c.$

This is the primitive equation upon the hypothesis that $y = 0$ when $x = 0$.

On the resolution of fluxional equations by approximation, consult Euler *Instit. Cal. Integ.* vol. i. sect. 2; Lacroix *Traité du Cal. Dif.* Part ii. Chap. 6.

Of Fluxional Equations of the Second and Higher Orders.

Of fluxional equations of the second and higher orders.

182. Let $f(x, y, c, c')$ denote any function, or expression composed of the variable quantities x, y, and two constant quantities c, c', besides any other constant quantities. Then

$$f(x, y, c, c') = 0. \qquad (1)$$

may represent any primitive equation. By taking the fluxion, (as explained Art. 45—50,) we obtain its fluxional equation of the first order, which will contain $\frac{dy}{dx}$ in addition to the other quantities, and may be expressed thus,

$$f'\left(x, y, \frac{dy}{dx}, c, c'\right) = 0. \qquad (2)$$

By taking the fluxions a second time, an equation will result, involving the fluxional co-efficient of the second order $\frac{d^2y}{dx^2}$, which may be expressed thus,

$$f''\left(x, y, \frac{dy}{dx}, \frac{d^2y}{dx^2}, c, c'\right) = 0. \qquad (3)$$

As these three equations will all hold true at once, we may exterminate the two constant quantities c, c', and the result will be a single equation

$$F\left(x, y, \frac{dy}{dx}, \frac{d^2y}{dx^2}\right) = 0, \qquad (4)$$

in which the quantities c, c' are not found. This will be the fluxional equation of the second order corresponding to the primitive (1), and which is independent of the constant quantities c, c'.

We may arrive at the very same equation (4) in two other ways.

1. We may give the primitive (1) these two forms,

$$\varphi(x, y, c) = c', \quad \psi(x, y, c') = c.$$

Here φ and ψ are symbols, which serve the same purpose as f, f', f'', &c. Taking the fluxions of these equations, c' is not found in the result of the first, nor c in the result of the second. These results may therefore be put under the form

$$\varphi'\left(x, y, \frac{dy}{dx}\right) = c, \quad \psi'\left(x, y, \frac{dy}{dx}\right) = c'.$$

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By taking now the fluxions of these equations, we shall derive the very same equation from each, which will be identical with equation (4.)

For example, let the primitive equation be

$$x^2 - 2ax + 2by = 0;$$

here a and b may represent the constant quantities c, c′ in equation (1); by taking the fluxions, regarding dx as constant, we find,

$$x - a + b\frac{dy}{dx} = 0, \quad 1 + b\frac{d^2y}{dx^2} = 0.$$

After eliminating a and b by these three equations, we get

$$2y - 2x\frac{dy}{dx} + x^2\frac{d^2y}{dx^2} = 0,$$

a fluxional equation of the second order, of which the complete primitive equation is $x^2 - 2ax + 2by = 0$. We may otherwise put the primitive equation under these forms

$$\frac{x^2 + 2by}{x} = 2a, \quad \frac{x^2 - 2ax}{y} = -2b.$$

Taking the fluxions, and arranging the results, so that the constant quantities may stand alone, we have

$$\frac{x^2}{y - x\frac{dy}{dx}} = 2b, \quad \frac{2xy - x^2\frac{dy}{dx}}{y - x\frac{dy}{dx}} = 2a.$$

By taking the fluxion of either of these equations, the constant quantity in the second member disappears, and we find $2y - 2x\frac{dy}{dx} + x^2\frac{d^2y}{dx^2} = 0$, the same as before.

183. As two of the constant quantities contained in a primitive equation may not be found in the fluxional equation of the second order, which is derived from it, so, on the other hand, in returning from a fluxional equation of the second order, to its absolute primitive, *the latter cannot be complete unless it contain two arbitrary constant quantities, which are not in the former.* Moreover, as the same fluxional equation of the second order may be derived from two distinct fluxional equations of the first order, *every fluxional equation of the second order has two primitive equations of the first order, each containing its own arbitrary constant quantity, and these again have one and the same absolute primitive equation, which is also the complete primitive, belonging to the fluxional equation of the second order.* The properties of fluxional equations of the third and higher orders are perfectly analogous to these. See Lagrange *Leçons sur le Calcul. des Fonctions*, Leçon xii.

184. The most simple fluxional equation of the second order is $\frac{d^2y}{dx^2} = X$, some function of x, or $\frac{d^2y}{dx} = Xdx$. Let us suppose that P is the variable part of the fluent of Xdx, then taking the fluent of both members of the equation, and considering that, in the first member, dx in the denominator is constant, we have

$$\frac{dy}{dx} = \int X\,dx = P + c, \text{ and } dy = P\,dx + c\,dx.$$

Taking now the fluents a second time,

$$y = \int P\,dx + cx + c'.$$

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As $\int P\,dx = Px - \int x\,dP = x\int X\,dx - \int x\,X\,dx$; therefore, $y = x\int X\,dx - \int x\,X\,dx + cx + c'$.

Here c and c' are the two constant corrections th complete the primitive equation. For example, if $dy^2 - ax\,dx^2 = 0$, here $X = ax$, in this case,

$$y = \tfrac{1}{2}ax^3 - \tfrac{1}{3}ax^3 + cx + c' = \tfrac{1}{6}ax^3 + cx + c'.$$

In the very same way, the primitive of the fluxional equation $d^3y - X\,dx^3 = 0$, may be found; we first put it under the form $\frac{d^3y}{dx^2} = X\,dx$, then we have $\frac{d^2y}{dx^2} = \int X\,dx = P + c$, where P denotes the fluent $\int X\,dx$. The equation is now of the second order; therefore the rest of the operation is the same as has been explained. The primitive will contain three constant corrections: a like fluxional equation of the fourth order would contain four, and so on.

185. When a fluxional equation of the second order contains only $\frac{dy}{dx}$, $\frac{d^2y}{dx^2}$, and constant quantities, if we put $\frac{dy}{dx} = p$, then, dx being regarded constant, $\frac{d^2y}{dx^2} = \frac{dp}{dx}$; the equation will now involve p, dp, dx, and constant quantities, and it will be of the first order in respect of p and x: we may thence find $dx = P\,dp$, P being put for some function of p; and since $dy = p\,dx = P\,p\,dp$, we have

$$x = \int P\,dp,\ y = \int P\,p\,dp$$

These fluents being taken, and a constant quantity added to each, by eliminating p, we shall get an equation expressing the relation between x and y.

Ex. Let $a\frac{d^2y}{dx^2} + \left(1 + \frac{dy^2}{dx^2}\right)^{\frac{3}{2}} = 0$; when p is put for $\frac{dy}{dx}$ and $\frac{dp}{dx}$ for $\frac{d^2y}{dx^2}$; this equation becomes $\frac{a\,dp}{dx} + (1+p^2)^{\frac{3}{2}} = 0$, hence

$$dx = \frac{-a\,dp}{(1+p^2)^{\frac{3}{2}}},\ dy = \frac{-ap\,dp}{(1+p^2)^{\frac{3}{2}}};$$

and taking the fluents

$$x = c - \frac{ap}{\sqrt{(1+p^2)}},\quad y = c' + \frac{a}{\sqrt{(1+p^2)}};$$

hence $(c-x)^2 + (y-c')^2 = a^2$.

By putting the proposed fluxional equation under this form

$$a = -\frac{(dx^2+dy^2)^{\frac{3}{2}}}{dx\,d^2y}$$

we see immediately (art. 86.) that the second member is the general expression for the radius of curvature, and that the equation is the analytical expression of this problem: To find a curve whose radius of curvature may be a constant quantity. The primitive equation just now found shews it to be a circle, which indeed is sufficiently evident.

186. Let us next consider equations of the form $\frac{d^2y}{dx^2} = Y$, some function of y. Putting as before $\frac{dy}{dx} = p$, we have $\frac{d^2y}{dx^2} = \frac{dp}{dx} = \frac{p\,dp}{dy}$; hence the proposed equation becomes, after substitution, $\frac{p\,dp}{dy} = Y$, and

Inverse Method.

$p\,dp = Y\,dy$, and $p^2 = 2\int Y\,y + c$, therefore $p = \frac{dy}{dx}$ $= \sqrt{(c + 2\int Y\,dy)}$, and

$$x = \int \frac{dy}{\sqrt{(c+2\int Y dy)}} + c',$$

where c and c' denote any two constant quantities.

Ex. Let the equation be $d^2y - y\,dx^2 = a\,dx^2$, or $\frac{d^2y}{dx^2} = a + y$. Here $Y = a + y$, and $2\int Y\,dy = 2ay + y^2$, hence

$$x = \int \frac{dy}{\sqrt{(c + 2ay + y^2)}} \cdot + c'$$

$$= \text{l.}\left\{a + y + \sqrt{(c + 2ay + y^2)}\right\} + c'. \quad (123)$$

187. When the equation contains $\frac{d^2y}{dx^2}$, $\frac{dy}{dx}$, and x, it may be transformed to a fluxional equation of the first order, by substituting $p\,dx$ for dy, and $dp\,dx$ for d^2y: then, if we can find the primitive of that fluxional equation, and thence the value of p in terms of x, we may have the value of y from the formula $y = \int p\,dx$, or else, if we have the value of x in terms of p, then because $\int p\,dx = px - \int x\,dp$, we shall have $y = px - \int x\,dp$.

Ex. Suppose the equation to be

$$-\frac{(dx^2 + dy^2)^{\frac{3}{2}}}{dx\,d^2y} = X,\ \text{or} -\frac{(1+p^2)^{\frac{3}{2}}\,dx}{dp} = X,$$

where X denotes some function of x then

$$\frac{dx}{X} = \frac{-dp}{(1+p^2)^{\frac{3}{2}}},\ \text{and} \int\frac{dx}{X} = \frac{-p}{\sqrt{(1+p^2)}}.$$

Let V represent $\int\frac{dx}{X}$, then $p = \frac{V}{\sqrt{(1-V^2)}}$ and $y = \int p\,dx = \int \frac{V\,dx}{\sqrt{(1-V^2)}}$.

As the first member of the proposed fluxional equation expresses the radius of curvature of any curve, its primitive equation expresses the nature of a curve whose radius of curvature is a given function of the abscissa.

188. If the fluxional equation contain $\frac{d^2y}{dx^2}$, $\frac{dy}{dx}$, and y, we may, as before, put $p = \frac{dy}{dx}$, from which we get $\frac{d^2y}{dx^2} = \frac{dp}{dx} = \frac{p\,dp}{dy}$: the equation will now involve dp, dy, p and y only. When the primitive equation can be found, and thence the value of p in terms of y, we may find x by the formula $x = \int\frac{dy}{p}$; but when y is expressed by p, we may then employ the formula $x = \frac{y}{p} + \int\frac{y\,dp}{p^2}$.

189. In fluxional equations of the first order, it is the same thing whether y be considered as a function of x, or x as a function of y. Either hypothesis leads to the same primitive equation. In fluxional equations of the second order, however, it must always be under-

stood which of the two is the independent variable quantity, because it is the fluxion of this quantity that is considered as constant, or that serves as an unit to measure the fluxion of the other quantity. We have supposed y to be a function of x, so that $d\,x$ is considered as constant; but to pass from the hypothesis of y a function of x, to that of x a function of y; and, consequently, from the hypothesis of $d\,x$ constant, and $d\,y$ variable, to that of $d\,y$ constant, and $d\,x$ variable, it is only necessary to have recourse to the formulæ of art. 96, and put $-\frac{d\,y\,d^2\,x}{d\,x^3}$ for $\frac{d^2\,y}{d\,x^2}$. A similar remark may be made respecting the fluxions of any order whatever.

Or, instead of regarding x and y as functions the one of the other, they may both be referred to some other variable quantity t, by means of the formulæ above quoted.

Example. Let the equation be $(a+x)\frac{d^2\,y}{d\,x^2}-\frac{dy}{dx}+\frac{x}{b}\;\frac{d\,y^2}{d\,x^2}=0$, in which dx is constant; by making the above substitution, it becomes $(a+x)\frac{d^2\,x}{d\,y^2}-\frac{x}{b}\;\frac{dx}{dy}+\frac{d\,x^2}{d\,y^2}=0$, in which dy is regarded as constant.

190. Fluxional equations of the second order, which have this form,

$$\frac{d^2\,y}{d\,x^2}+\mathrm{P}\frac{dy}{dx}+\mathrm{Q}y=\mathrm{R},$$

P, Q, and R, being any functions of x, are called *linear*, because y is only of one dimension; they are also said to be of the *first degree*.

It may be easily supposed, that the difficulty of finding the primitive equation will be greater than in the like equation of the first order, and indeed, except in particular cases, there are no known methods of reducing the problem to the finding of the fluxion of a single variable quantity, that is, to the quadrature of curves.

If $\mathrm{R}=0$, in which case the equation is

$$\frac{d^2y}{dx^2}+\mathrm{P}\,\frac{d\,y}{d\,x}+\mathrm{Q}y=0,$$

it may be reduced to a fluxional equation of the first order by a very simple transformation. Putting e for the number of which the Nap. log. $=1$, assume $y=e^{\int u\,dx}$, then, taking the fluxions, by art. 26. rule (C), considering $d\,x$ as constant,

$$d\,y=u\,d\,x\,e^{\int u\,dx},\; d^2y=e^{\int u\,dx}\,(d\,u\,d\,x+u^2\,d\,x^2).$$

The values of $d\,y$ and $d^2\,y$ being substituted in the equation, and the common factors rejected, it becomes

$$d\,u+(u^2+\mathrm{P}u+\mathrm{Q})\,d\,x=0.$$

If P and Q were constant quantities, u might have been supposed a constant quantity, we then have $d\,u=0$, and to determine u we have

$$u^2+\mathrm{P}u+\mathrm{Q}=0.$$

Let a and b be the roots of this quadratic equation; then $u=a$ and $u=b$, and hence these two values of y,

$$y=e^{ax+c},\; y=e^{bx+c'};$$

or putting C for e^{c}, and C′ for $e^{c'}$,

$$y=\mathrm{C}e^{ax},\; y=\mathrm{C}'e^{bx}.$$

These, however, are only *particular* values of the function y, because each contains only a single arbitrary constant quantity, but by adding them we get

$$y=\mathrm{C}e^{ax}+\mathrm{C}'e^{bx},$$

for the complete primitive equation. To prove this, by taking the fluxions we get

$$\frac{d\,y}{d\,x}=a\,\mathrm{C}e^{ax}+b\mathrm{C}'e^{bx},\;\frac{d^2y}{dx^2}=a^2\mathrm{C}e^{ax}+b^2\mathrm{C}'e^{bx}.$$

From these, and the primitive equation, after eliminating C and C′, we have

$$\frac{d^2y}{d\,x^2}+(a+b)\,\frac{d\,y}{d\,x}-a\,b\,y=0.$$

This will agree with the proposed equation, if we give a and b such values, that $a+b=\mathrm{P}$, and $a\,b=-\mathrm{Q}$. If a and b come out impossible quantities, then the exponents of e, in the value of y, will have the form $\alpha+\beta\sqrt{-1}$, but then the exponential $e^{\beta\sqrt{-1}}$, may be expressed by circular functions. Art. 123, and Arithmetic of Sines.

191. When P and Q are variable quantities, functions of x, then if v and v' are two values of y, which each satisfy the equation $\frac{d^2\,y}{d\,x^2}+\mathrm{P}\frac{dy}{dx}+\mathrm{Q}y=0$, we may take

$$y=\mathrm{C}\,v+\mathrm{C}'\,v',$$

for the complete primitive equation. For then $dy=\mathrm{C}\,dv+\mathrm{C}'\,dv'$, $d^2y=\mathrm{C}d^2v+\mathrm{C}'\,d^2v'$, and the fluxional equation becomes

$$\mathrm{C}\left(\frac{d^2v}{dx^2}+\mathrm{P}\frac{dv}{dx}+\mathrm{Q}v\right)+\mathrm{C}'\left(\frac{d^2v'}{dx^2}+\mathrm{P}\frac{dv'}{dx}+\mathrm{Q}v'\right)=0.$$

Now by hypothesis

$$\frac{d^2\,v}{d\,x^2}+\mathrm{P}\frac{dv}{dx}+\mathrm{Q}v=0,\;\frac{d^2v'}{dx^2}+\mathrm{P}\frac{d\,v'}{d\,x}+\mathrm{Q}\,v'=0,$$

therefore the equation is identical, and so the value of y is truly determined.

The property which we have shewn to belong to a linear equation of the second order applies to linear equations of all orders whatever. See Lagrange *Theorie des Fonct. Anal.* 65—70.

192. As an example of the manner of resolving a fluxional equation of the second order by approximation, let the equation be

$$d^2\,y+a\,x^n\,y\,d\,x^2=0.$$

Let us suppose that

$$y=x^{\lambda}\,(\mathrm{A}+\mathrm{B}x^{n+2}+\mathrm{C}\,x^{2n+4}+\mathrm{D}\,x^{3n+6}+\&c.),$$

thence we deduce $\frac{d^2\,y}{d\,x^2}=$

$$\lambda(\lambda-1)\mathrm{A}x^{\lambda-2}+(\lambda+n+2)(\lambda+n+1)\mathrm{B}x^{\lambda+n}+\&c.$$

$$a\,x^n\,y=\qquad\qquad a\,\mathrm{A}\,x^{\lambda+n}+\&c.$$

Hence, after substituting in the proposed equation, we get

$$\lambda\,(\lambda-1)\,\mathrm{A}=0,$$

$$(\lambda+n+2)\,(\lambda+n+1)\,\mathrm{B}+\mathrm{A}\,a=0,\;\&c.$$

The first equation ought to leave A indeterminate, as one of the two constant corrections that enter into the value of y; that this may be the case, we must have $\lambda=0$, or $\lambda=1$. First, suppose $\lambda=0$, then,

$$B = -\frac{aA}{(n+1)(n+2)},$$

$$C = \frac{a^2 A}{1.2.(n+1)(2n+3)(n+2)^2},$$

$$D = \frac{-a^3 A}{1.2.3(n+1)(2n+3)(3n+5)(n+2)^3}, \text{ \&c.}$$

Hence we have a primitive equation expressed by a series, but it is incomplete, because it contains only one arbitrary constant quantity. Let us next consider the case of $\lambda = 1$, and putting A′, B′, C′, &c. for the corresponding values of the coefficients A, B, C, &c. of which the first remains always arbitrary, we have

$$B' = \frac{-aA'}{(n+3)(n+2)}$$

$$C' = \frac{a^2 A'}{1.2.(n+3)(2n+5)(n+2)^2}$$

$$D' = \frac{-a^3 A'}{1.2.3(n+3)(2n+5)(3n+7)(n+2)^3}$$

&c.

This gives a second incomplete primitive equation: by adding the two values of y, we get

$$y = A + Bx^{n+2} + Cx^{2n+4} + Dx^{3n+6} + \text{\&c.}$$
$$+ A'x + B'x^{n+3} + C'x^{2n+5} + D'x^{3n+7} + \text{\&c.}$$

for the complete primitive equation (art. 191.), where A and A′ are the two arbitrary corrections. If m is positive and greater than unity, the series will converge so much the faster, as x is smaller. In certain cases, however, it will fail, because all the terms will become infinite. This happens in particular when $n = -2$. But then we may assume $y = ax^{\lambda}$, and the equation will become $\lambda(\lambda - 1) + a = 0$, which gives two values of λ. Let them be λ and λ'. The two incomplete fluents are $y = ax^{\lambda}$ and $y = a'x^{\lambda'}$, and their sum $y = ax^{\lambda} + a'x^{\lambda'}$ is the complete primitive equation. See Euler *Instit. Calc. Integ.* vol. ii. cap. 7; Lacroix *Traite du Calc. Diff.* &c. Part ii. chap. 6. This last work, as it is the latest and most copious, may be considered as exhibiting the most complete view of the theory of fluxions of any extant.

Miscellaneous Problems.

In- pro-

193. Having now given as full a view of the principles of the fluxional calculus as we conceive to be compatible with the nature of our work, we shall conclude with a few more examples of its application to the resolution of particular problems.

Prob. 1. To find the length of the enlarged meridian in *Mercator's*, or rather *Wright's* projection of the sphere.

In this projection, the meridians and parallels of latitude are straight lines, which intersect each other at right angles; and the projection of any small arc of a meridian, (as one minute,) reckoned from any parallel, is to the projection of a like arc of longitude in that parallel, as radius to the cosine of the latitude of the parallel, that is, in the same ratio as the arcs themselves on the sphere. Supposing the radius of the sphere to be unity, let v be any arc of latitude reckoned from the equator, z its projection on the chart, or the *enlarged meridian*. Let v' and z' be any small increments of v and z, then, by the principles of the projection, $\frac{z'}{v'} = \frac{rad}{\cos. v}$, therefore, putting the ratio of the fluxions for the limit of the ratio of the increments, $\frac{dz}{dv} = \frac{1}{\cos. v}$, and $dz = \frac{dv}{\cos. v}$. Therefore, taking the fluent (art. 146), $z = \text{l.} \left\{ \tan. (45^\circ + \frac{1}{2} v) \right\}$. Here no correction is wanted, because when $v = 0$, then $z = \text{l.} (\tan. 45^\circ) = \text{l.} (1) = 0$, as it should be.

If we compare the fluxion of z with that of the difference of a parabolic arc and its tangent, (art. 158,) it will appear that they are identical. Hence we have this elegant theorem. If, from the focus of a parabola, a perpendicular be drawn to any tangent to the curve, and a circle be described on the focus as a centre to pass through the vertex; the meridional parts corresponding to the arc of the circle between the vertex, and the perpendicular to the tangent, is equal to the excess of the parabolic arc between the vertex and point of contact, above that portion of the tangent which is intercepted between the same point and perpendicular.

Henry Bond, in the year 1650, discovered, by chance, that the enlarged meridian might be expressed by the logarithmic tangents of half the complements of the latitudes, a rule easily found from the preceding solution; but the difficulty of proving this was then considered so great, that Mercator offered to wager a sum of money against any person that should undertake to prove it, either true or false. James Gregory, however, proved it in his *Exercitationes Geometricæ*, published in 1668, and afterwards Barrow, in his Geometrical Lectures; their demonstrations, however, were intricate. Afterwards Dr Wallis and Dr Halley gave demonstrations, which were sufficiently simple and elegant.

Fig. 43.

Prob. 2. A body T proceeds uniformly along a straight line BC, (Fig. 43), and a body S in pursuit of T, moves always directly towards it, with a velocity which is to that of T in the given ratio of 1 to n; what is the nature of the curve described by S?

Let the tangent AB, which makes right angles with BC, be put $= a$, the abscissa BR $= x$, the ordinate SR $= y$, the arc AS $= z$, then the subtangent RT $= -y\frac{dx}{dy}$ (art. 67,) and BT $= x - y\frac{dx}{dy}$: Now BT and AS being described in the same time, they are to each other as the velocities n and 1, therefore BT $= n \times$ AS, that is $x - y\frac{dx}{dy} = nz$, and hence, taking the fluxions, making dy constant, $-y\frac{d^2x}{dy} = n\,dz$; but $dz = \sqrt{(dx^2 + dy^2)}$, therefore

$$-\frac{n\,dy}{y} = \frac{d^2x}{\sqrt{(dx^2 + dy^2)}}.$$

Put $dx = p\,dy$, then $d^2x = dp\,dy$; hence, by substitution in the second member,

$$-\frac{n\,dy}{y} = \frac{dp}{\sqrt{(1+p^2)}},$$

and taking the fluents,

$$c - n\,\text{l.}(y) = \text{l.}\left\{p + \sqrt{(1+p^2)}\right\}.$$

Now, because $p=\frac{dx}{dy}=$ tan. RST (art. 67) when $y=a$, then $p=0$, in this case the general equation of the fluents becomes $c-n\,\mathrm{l.}(a)=0$; therefore $c=n\,\mathrm{l.}(a)$, hence $n\,\mathrm{l.}\ (a)-n\,\mathrm{l.}\ (y)=\mathrm{l.}\left\{p+\sqrt{(1+p^2)}\right\}$, and $\mathrm{l.}\ \frac{a^n}{y^n}=\mathrm{l.}\left\{p+\sqrt{(1+p^2)}\right\}$, and $\frac{a^n}{y^n}=p+\sqrt{(1+p^2)}$. By resolving this equation in respect of p, and putting for p its value $\frac{dx}{dy}$, we find

$$2\,dx=\frac{a^n\,dy}{y^n}-\frac{y^n\,dy}{a^n},$$

and taking the fluents a second time,

$$2x=-\frac{a^n\,y^{1-n}}{1-n}+\frac{a^{-n}\,y^{n+1}}{n+1}+c;$$

but when $y=a$, x is $=0$; therefore $0=-\frac{a}{1-n}+\frac{a}{n+1}+c$, and $c=-\frac{2\,n\,a}{1-n^2}$, and the equation of the curve is

$$2x=-\frac{a^n\,y^{1-n}}{1-n}+\frac{a^{-n}\,y^{n+1}}{n+1}-\frac{2\,n\,a}{1-n^2}.$$

This line is the *curve of pursuit* remarked by Bouguer and Maupertuis, (*Mem. de l'Acad. des Sciences,* 1732).

Prob. 3. If any number of straight lines are drawn according to some determinate law, it is required to find the nature of a curve to which these are tangents.

Fig. 45. For example, let AE be a straight line given by position, (Fig. 45), and K a given point without it; let any number of lines KD, KD′, &c. be drawn, to meet AE in D, D′, &c.; and let perpendiculars DC, D′C′, &c. be drawn to these lines; it is required to find the nature of the curve ACC′, to which these perpendiculars are tangents.

Fig. 44. Without attending to the particular case, we shall resolve the general problem, and suppose AE to be the axis of the curve (Fig. 44), A being the origin of the co-ordinates, and CD any position of the tangent, which meets the axis in D. From the point of contact C, draw the perpendicular CB; and, considering C as a point in the curve, put AB$=x$, BC$=y$; but again considering C as any point whatever in the tangent, put AB$=x'$, BC$=y'$. Then, whatever be the conditions that determine the position of the tangent, the relation of x' and y' the co-ordinates of any point in it, may be expressed by the equation $y'=\mathrm{P}\,x'+\mathrm{Q}$, where P and Q are put to denote generally certain functions of constant quantities, and some quantity p, which has the same value for any given position of the tangent, but which changes its value if the tangent changes its position. For example, p may express the angle which the tangent makes with the axis, or it may represent the sub-tangent BD, &c.

Let us now suppose, that the variable quantity p changes its value and becomes $p+h$, and that C′ D′ is the new position of the tangent corresponding to $p+h$; then, considering P and Q as functions of p, by Taylor's theorem (art. 5[illegible].)

$$\mathrm{P}\text{ becomes }\mathrm{P}+\frac{d\mathrm{P}}{dp}h+\frac{d^2\mathrm{P}}{dp^2}\frac{h^2}{2}+\&\text{c.}$$

$$\mathrm{Q}\text{ becomes }\mathrm{Q}+\frac{d\mathrm{Q}}{dp}h+\frac{d^2\mathrm{Q}}{dp^2}\frac{h^2}{2}+\&\text{c.}$$

The relation of x' to y' in the new position of the tangent will now be expressed by the equation

$$y'=\mathrm{P}\,x'+\mathrm{Q}+\left(\frac{d\mathrm{P}}{dp}x'+\frac{d\mathrm{Q}}{dp}\right)h+\mathrm{K}\,h^2+\&\text{c.}$$

Where $\mathrm{K}\,h^2+$ &c. is put for all the remaining terms of the series.

Now, as this equation holds true of every point in the tangent C′ D′, and the equation $y'=\mathrm{P}\,x'+\mathrm{Q}$ holds true of every point in the tangent CD, it follows, that at c, the intersection of the two tangents, both equations must be true at the same time; therefore at c we have

$$\left(\frac{d\mathrm{P}}{dp}x'+\frac{d\mathrm{Q}}{dp}\right)h+\mathrm{K}\,h^2+\&\text{c.}=0;$$

and dividing by h, $\frac{d\mathrm{P}}{dp}x'+\frac{d\mathrm{Q}}{dp}+\mathrm{K}\,h+\&\text{c.}=0.$

Conceive now the two tangents to approach to coincidence; when C′ come to C, then c will also fall at C; and h, and all the terms into which it enters, vanish; also x' and y' become x and y: and to determine the nature of the curve, we have these two equations:

$$y=\mathrm{P}\,x+\mathrm{Q} \qquad (1.)$$

$$0=\frac{d\mathrm{P}}{dp}x+\frac{d\mathrm{Q}}{dp} \qquad (2.)$$

By eliminating p from these, the resulting equation will express the nature of the curve.

Example 1. Let us now recur to the particular case of AE, a straight line given by position (Fig. 45.), K a given point, and KDC a right angle: Draw KA perpendicular to AE; put AB$=x$, BC$=y$, KA$=a$, and let AD be the variable quantity p. The triangles KAD, DBC are manifestly similar; therefore KA : AD :: DB : BC, that is, $a:p::x-p:y$; hence $a\,y=p\,x-p^2$, and $y=\frac{p}{a}x-\frac{p^2}{a}$. Compare this with equation (1.), and it will appear that $\mathrm{P}=\frac{p}{a}$, $\mathrm{Q}=-\frac{2p}{a}$; therefore $\frac{d\mathrm{P}}{dp}=\frac{1}{a}$; $\frac{d\mathrm{Q}}{dp}=-\frac{2p}{a}$; hence the nature of the curve is expressed by the two equations, Fig. 45.

$$y=\frac{p}{a}x-\frac{p^2}{a};\ 0=\frac{1}{a}x-\frac{2p}{a}.$$

The second of these equations gives $p=\frac{1}{2}x$; and hence the first becomes $y=\frac{x^2}{2a}-\frac{x^2}{4a}$; therefore $4\,a\,y=x^2$ is the equation of the curve, which is evidently a parabola, of which AK is the axis, K the focus, and A the vertex.

Ex. 2. Suppose a ray of light RD (Fig. 46.) coming from the sun to fall upon FEG, the concave surface of a sphere at D; and to be thence reflected in the direction DH; it is proposed to find the nature of the curve to which this, and all rays reflected in the same manner, are tangents. Fig. 46.

Draw AD the radius of the sphere, and AE parallel to the incident ray RD; let C be the point in which the reflected ray touches the curve; let DC meet AE in H, and draw CB perpendicular to AE. Put AD$=a$, AB$=x$, BC$=y$, and let p be the variable angle DAE.

By the principles of optics, AD bisects the angle RDH, which is equal to DHE, that is to the sum of the angles DAH, ADH; therefore the angles ADH, DAH are equal, and angle DHE $=2\,p$. Now, by trigonometry,

$$\mathrm{AH}=\frac{\sin.\ \mathrm{ADH}}{\sin.\ \mathrm{AHD}}\times\mathrm{AD}=\frac{\sin.\ p}{\sin.\ 2p}a,$$

$$\mathrm{BH}=\frac{\cos.\ \mathrm{CHB}}{\sin.\ \mathrm{CHB}}\times\mathrm{CB}=\frac{\cos.\ 2p}{\sin.\ 2p}y;$$

Hence $x=(\mathrm{AH}+\mathrm{BH})=\frac{\sin.\ p}{\sin.\ 2p}a+\frac{\cos.\ 2p}{\sin.\ 2p}y,$

and $y=\frac{\sin.\ 2p}{\cos.\ 2p}x-\frac{\sin.\ p}{\cos.\ 2p}a.\qquad(\alpha)$

By comparing this with the general formula (1), it appears that

$$\mathrm{P}=\frac{\sin.\ 2p}{\cos.\ 2p},\ \ \mathrm{Q}=-\frac{\sin.\ p}{\cos.\ 2p}a;\ \text{hence,}$$

$$\frac{d\mathrm{P}}{dp}=\frac{2}{\cos.^2 2p},\ \ \frac{d\mathrm{Q}}{dp}=-\frac{\cos.\ p}{\cos.\ 2p}a-\frac{2\sin.\ 2p\sin.\ p}{\cos.^2 2p}a:$$

Hence, by formula (2),

$$\frac{2x}{\cos.^2 2p}=\left\{\frac{\cos.\ p}{\cos.\ 2p}+\frac{2\sin.\ 2p\sin.\ p}{\cos.^2 2p}\right\}a.\qquad(\beta)$$

From equations (α) and (β) we readily find,

$$x=(\tfrac{1}{2}\cos.\ 2p\cos.\ p+\sin.\ 2p\sin.\ p.)\ a$$
$$y=(\tfrac{1}{2}\sin.\ 2p\cos.\ p-\cos.\ 2p\sin.\ p)\ a;$$

and hence, by observing that $\sin.\ 2p=2\sin.\ p\cos.\ p$, and that $\cos.\ 2p=2\cos.^2 p-1=1-2\sin.^2 p$, (Arithmetic of Sines,) we have also

$$x=\tfrac{1}{2}\cos.\ p(1+2\sin.^2 p)\,a;\ \ y=\sin.^3 p\,a.$$

From these equations it is easy to eliminate the trigonometrical quantities cos. p and sin. p, and the result will be the equation of the curve, which is an epicycloid, as we have demonstrated synthetically in the article Epicycloid. The curve in question is the *catacaustic* curve to a circle.

It is easy to see, that the general problem, of which we have now given two examples, is very comprehensive. We may evidently find by the formulæ (1) and (2), *catacaustic* and *diacaustic* curves in all cases whatever. If the tangents DC, D′C′, &c. (Fig. 44.) be normals to another curve, then the curve whose nature is sought will be the *evolute* of that curve; so that the problem applies also to the theory of evolutes. These, and an infinite number of other geometrical problems, are contained in the following more general problem.

ig. 44.

Prob. 4. Determine the nature of a curve which touches an infinite number of lines of a given kind, described upon a plane according to some determinate law: For example, suppose the lines to be parabolas, described by a projectile thrown from an engine with a given velocity, at every possible elevation, in a vertical plane. Let HCD (in Fig. 47.) be any one of the lines of a given kind, (a parabola for example,) and suppose it referred to an axis AB, by the rectangular co-ordinates $\mathrm{AB}=x'$ and $\mathrm{BC}=y'$. Let p denote some quantity belonging to the line, or curve HCD, which has always the same value in the same curve, but which has different values in different curves. Thus, if the curve be a circle, p may be its radius; or if the curve be a parabola, p may be its parameter, &c. This quantity p may also by analogy be called the *parameter* of the curve HCD. Let us suppose the nature of this curve to be expressed by the equation

. 47.

$$f(x',y',p)=0,\qquad(1)$$

that is, let some function of x', y', and p, be supposed $=0$. If p now be supposed to change its value, and become $p+h$, then the curve HCD will change its figure, and have some other position H′C′D′. Let $\mathrm{AB}'=x''$, and $\mathrm{B'C'}=y''$, be any co-ordinates of this other curve, and as, by hypothesis, the two curves are expressed by equations of the same form, we must have

$$f(x'',y'',p+h)=0;$$

and this expression, by Taylor's theorem, is equivalent to

(2.)

$$f(x'',y'',p)+\frac{d\left\{f(x'',y'',p)\right\}}{dp}h+\mathrm{K}h^2+\&\mathrm{c}.$$

The fluxion being taken upon the hypothesis that p alone is variable, and $\mathrm{K}h^2+$ &c. being put for all terms of the series following the second, each of which is multiplied by a power of h.

Let the two curves intersect each other in c, and let $\mathrm{A}b=x$, and $cb=y$, be the common co-ordinates; then, as equation (1) holds true of every point in the curve HCD, and equation (2) holds true of every point in H′C′D′, both must hold true at once, if we substitute in them x and y, the co-ordinates belonging to their common point c; that is, we must have

$$f(x,y,p)=0,$$

$$f(x,y,p)+\frac{d\left\{f(x,y,p)\right\}}{dp}h+\mathrm{K}h^2+\&\mathrm{c}.=0,$$

and hence we must also have

$$\frac{d\left\{f(x,y,p)\right\}}{dp}+\mathrm{K}h+\&\mathrm{c}.=0.$$

Let C and C′ be now supposed the points in which the curves HcD, H′cD′ touch the curve PCC′Q, whose nature is required; then, if we suppose h to decrease continually, and at last to vanish, the points C′ and c will approach to C, and at last will coincide with it, so that x and y, which are co-ordinates of c, the intersection of the two curves HcD, H′cD′, will then become the co-ordinates of the curve PCQ. As all the terms which contain h will then vanish, we have evidently this rule.

Let the equation of the given curves be

$$f(x,y,p)=0,\qquad(\alpha)$$

x and y being the co-ordinates, and p a variable parameter. From this equation, by taking the fluxion, supposing p to be variable, and all the other quantities constant, deduce this other equation,

$$\frac{d\left\{f(x,y,p)\right\}}{dp}=0.\qquad(\beta)$$

By these eliminate p, and the result will be an equation, which expresses the nature of the curve, that touches all the given curves.

This formula includes in it that of Prob. 3.

Example. Let ACD, AC′D′, &c. be parabolas described by a projectile thrown from a given point A, with a given velocity in a given vertical plane. It is proposed to find the curve PCQ which touches them all. Let EF be the axis of any one of the curves, AD an ordinate to the axis, $\mathrm{AP}=a$, the height due to the velocity of projection (see Projectiles), $\mathrm{AB}=x$, $\mathrm{BC}=y$, the co-ordinates of C, any point in the curve. Put the parameter of the axis $=p$, and considering AD as a function of p, which is to be regarded as variable, put $\mathrm{AD}=q$.

By the theory of projectiles, EF $= a - \frac{1}{4}p$, and by the nature of the parabola, AF$^2 = p \times$ EF, and AB $\times$ BD $= p \times$ BC; hence we have these two equations,

$$q\,x - x^2 = p\,y, \ (1) \qquad q^2 = 4\,a\,p - p^2, \ (2)$$

From the first of these,

$$f(x, y, p) = x^2 + p\,y - q\,x = 0,$$

and taking the fluxions, considering x and y as constant, and q as a function of the variable quantity p,

$$\frac{d\left\{f(x, y, p)\right\}}{dp} = y - \frac{dq}{dp}x = 0,$$

therefore $\frac{y}{x} = \frac{dq}{dp}$; but from equation (2), taking the fluxions, $q\,dq = 2\,a\,dp - p\,dp$, and hence $\frac{dq}{dp} = \frac{2a-p}{q}$, and by the first equation $\frac{y}{x} = \frac{q-x}{p}$, therefore $\frac{q-x}{p} = \frac{2a-p}{q}$, and hence $q^2 - q\,x = 2\,a\,p - p^2$, and substituting for q^2 its value given by equation (2), we get $q\,x = 2\,a\,p$; hence, and by equation (1),

$$p = \frac{x^2}{2a-y}, \qquad q = \frac{2\,a\,x}{2\,a-y}.$$

These values of p and q being substituted in the second equation, and the common denominator rejected, it becomes

$$4\,a^2\,x^2 = (8\,a^2 - 4\,a\,y - x^2)\,x^2.$$

Hence, $4\,a\,y = 4\,a^2 - x^2$, and this is the equation of the curve PCQ, which is evidently a parabola, having its focus at A, the common intersection of all the parabolas, its axis perpendicular to the horizon, and its parameter $= 4\,a$.

The geometrical theory comprehended in the third and fourth problems, has a corresponding analytical theory relating to the fluents of certain fluxional equations. This is the theory of *singular* primitive equations, which are not included in the *complete* primitive equation. Thus, the fluxional equation

$$dy\sqrt{(x^2 + y^2 - b)} - y\,dx - x\,dx = 0,$$

has for its complete primitive equation

$$x^2 - 2\,a\,y - a^2 - b = 0,$$

where a is the arbitrary constant quantity; but besides this, it has a *singular* primitive equation

$$x^2 + y^2 - b = 0,$$

which does not admit of an arbitrary constant correction, although it equally satisfies the fluxional equation, as is easily proved by taking the fluxions. The bounds within which it was proper to confine this treatise, have not allowed us to enter into this branch of the subject, which, although interesting, is yet not elementary. On this subject, see Euler, *Instit. Cal. Integ.* vol. i. sect. 3. cap. 4.; Lagrange, *Mem. de l'Acad. Ber.* 1774; also, *Leçons sur le Cal. des Fon.* Leç. 15, 16, and 17; Laplace, *Mem. de l'Acad. Par.* 1772; Legendre, *Mem. Acad.* 1790; Poisson, *Journal de l'Ecole Polytechnique* 13 *Cahier.*

Prob. 5. Supposing the two poles of a magnet to be given by position, and that the force of each is reciprocally as the nth power of the distance from it; it is required to find a curve in any point of which a needle (indefinitely short) being placed, its direction, when at rest, shall be a tangent to the curve.

To resolve this problem, it must be known that the north pole of the needle is repelled by the north pole of the magnet, and attracted by its south pole; and that the south pole of the needle is repelled by the south pole of the magnet, and attracted by its north pole. Let N (Fig. 48) be the north, and S the south pole of the magnet; and let NCS be the curve; and AB a straight line in the direction of the needle, which being, by hypothesis, indefinitely short, its poles may be considered as coinciding with its centre C: Join CN, CS. By the laws of magnetism, the attractive and repulsive forces of N and S are equal at equal distances. Therefore, if we take Ce and Cf proportional to the attractive force of N on the south pole of the needle, or its repulsive force on the north pole; also cg and and ch proportional to the attractive force of S on the north pole, or its repulsive force on the south pole of the needle; and complete the parallelograms eChs, fCgn, which will be equal in all respects, and have their diagonals Cs, Cn in the same straight line, by the principles of statics, the needle can only be at rest when its direction AB coincides with the diagonals sCn; because then, the forces Cs, Cn, which act upon its poles, pass through its centre.

Put NC $= p$, SC $= q$; by hypothesis $p^n : q^n ::$ Cg or Ch : Cf or Ce, but cg : Cf or gn :: sin. Cng : nCg, that is as sin. ACN : sin. BCS, therefore

$$p^n : q^n :: \text{sin. ACN} : \text{sin. BCS}.$$

From this geometrical property of a tangent to the curve, we are now to find an equation by which any number of points in it may be determined.

Let the angles CNS$=\varphi$, and CSN$=\psi$, and put z for the arc of the curve NC. It appears by art. 69, (formula 6,) that the tangent of the angle ACN is equal to $\frac{-p\,d\varphi}{dp}$, therefore its secant will be $\frac{\sqrt{(p^2\,d\varphi^2 + dp^2)}}{dp}$, but the numerator of this fraction expresses the fluxion of z, (art. 76, formula 2,) therefore, sec. ACN $= \frac{dz}{dp}$, and as sin. ACN $= \frac{\text{tan. ACN}}{\text{sec. ACN}}$, therefore, sin. ACN $= \frac{-p\,d\varphi}{dz}$: Similarly, we have sin. BCS $= \frac{q\,d\psi}{dz}$ (here the sign is positive, because the arc and angle increase together:) we have therefore $p^n : q^n :: -\frac{p\,d\varphi}{dz} : \frac{q\,d\psi}{dz}$ and $p^{n-1} : q^{n-1} :: -d\varphi : d\psi$; but in the triangle NCS, by trigonometry, $p : q ::$ sin. ψ : sin. φ, therefore sin.$^{n-1}\psi$: sin.$^{n-1}\varphi :: -d\varphi : d\psi$, hence we get sin.$^{n-1}\psi\,d\psi = -$ sin.$^{n-1}\varphi\,d\varphi$, and

$$\int \text{sin.}^{n-1}\varphi\,d\varphi + \int \text{sin.}^{n-1}\psi\,d\psi = c,$$

an equation which expresses the nature of the curve.

If the force be supposed inversely as the distance, then $n = 1$, and the equation is $\varphi + \psi = c$, a constant angle; hence it appears that, in this case, the curve is an arc of a circle passing through N and S.

If the force be inversely as the square of the distance, then $n = 2$, and the equation of the curve is

$$\int \text{sin.}\,\varphi\,d\varphi + \int \text{sin.}\,\psi\,d\psi = c,$$

or taking the fluents,

$$\text{cos.}\,\varphi + \text{cos.}\,\psi = c.$$

If a semicircle be described on NS as a diameter, cutting CN, CS in H and K, it is easy to see that NH, SK are to each other as the cosines of the angles S, N; therefore, by the nature of the curve, NH + SK will be equal to a constant line. By this property, if, besides the points N, S, any other point C be given, we can find as many more points in the curve as we please.

Miscellaneous Problems.

From experiments, it appears, that the supposition of $n=2$ agrees pretty well with the common phenomena of magnetism.

If n be supposed to have any other integer value, the fluents may be found by article 144.

Fig. 49.

Prob. 6. Suppose that a material point, placed at A, is impelled by two forces, one which urges it from A towards B, (Fig. 49.) with a motion uniformly accelerated, and the other on the contrary urges it from A towards D, with an intensity which is in the inverse ratio of the distance of the material point from B: It is proposed to determine the principal circumstances of the motion.

Let AB $=a$, AN $=s$, the space described by the point in a variable time t, and $v=$ the velocity which it acquires in the same time; let f denote the accelerating force, which impels it from N towards D, and m the value of the force at some given distance, (an unit), from the point B: By the nature of the question $\frac{\text{NB}}{1}$ or $\frac{a+s}{1}=\frac{m}{f}$, therefore $f=\frac{m}{a+s}$. Again, let g denote the constant accelerating force which acts upon the moveable point from N towards B; the force F, which actually impels it at the end of the time t, is the difference of these two forces, therefore $\text{F}=f-g$. From this expression, and the principles of Dynamics, (which see), we have these three equations

$$\text{F}=\frac{m}{a+s}-g,\quad \text{F}\,ds=v\,dv,\quad ds=v\,dt:$$

and by these we may eliminate any two of the four quantities F, s, v, t.

From the first and second we get $v dv=\left(\frac{m}{a+s}-g\right)ds$; and hence, taking the fluents

$$\frac{1}{2}v^2=m\log.(a+s)-gs+c:$$

To determine c, it is to be observed that at A, we have $v=0$, and $s=0$, hence $c=-m\log. a$, and the adjusted equation of the fluents is

$$v=\pm\surd\left\{2m\times\log.\left(\frac{a+s}{a}\right)-2g\right\}.$$

This equation gives the velocity which the moveable point has acquired after it has described the space s. To determine the time t, we must substitute for v its value in the equation $dt=\frac{ds}{v}$, and then take the fluent, which however must be found by approximation or infinite series.

If we suppose DB to be a cylindrical tube, open only at the upper end D, and A to be a piston, which fits the tube exactly, and descends vertically by the force of gravity, compressing the air in AB the lower part, then, as the force of the compressed air to urge the piston upwards, is known to be inversely as the space it occupies, that is inversely as AB, and as at the same time the piston is urged downwards by the force of gravity; if we abstract from friction, the piston will be urged by two forces exactly as we have supposed the material point in the enunciation of the general problem.

We have another example of this kind of motion in a bullet fired from a musket or cannon: By the inflammation of the gunpowder, the space it filled is suddenly occupied by a great quantity of elastic vapour, which in expanding, forces the bullet along the tube: If we suppose $s=$ AD, the distance from the mouth of the cannon at the beginning of the motion of the ball; $a+s$ is the whole length of the cannon, then v will be the velocity with which the ball leaves it: We may abstract from the resistance of the air and the weight of the bullet, which alter this velocity very little, besides when the cannon is horizontal, the weight is nothing: Therefore, making $g=0$, we have

$$v=\surd\left\{2m\log.\left(\frac{a+s}{a}\right)\right\}$$

a formula which is applicable to Gunnery.

For other examples of the application of fluxions to the theory of forces, see Dynamics, Sect. 5. (ξ)

y-Wheels, Flying.

FLY-Wheels. See Mechanics.

FLYING, Artificial. Mankind have always viewed the flight of the feathered tribes as an enviable faculty: they have ascribed it to beings more favoured than themselves, whose power was courted or dreaded by them; and, after indulging in innumerable fictions and legends concerning its operation, in regard to terrestrial objects, they have entertained expectations that it is one of the prerogatives of a celestial state. Some more hardy and intelligent, however, have even, from the remotest ages, conceived the practicability of conveying themselves through the air by mechanical expedients. But so incompatible has it appeared with the physical structure and abilities of the human frame, that "to fly in the air" has universally been regarded as one of those chimerical projects which no ingenuity could realize. Hence the learned Bishop Wilkins has truly observed, "amongst other impediments of any strange invention or attempts, it is none of the meanest discouragements that they are so generally derided by common opinion, being esteemed only as the dreams of a melancholy distempered fancy." Yet, on considering the nature of the atmosphere in common with other fluids, the disposal of matter of known specific gravity, and the application and effect of the mechanical powers, it does not seem altogether logical to declare it impossible for mankind to elevate themselves in the air by means of wings.

Flying.

Though more peculiarly the attribute of birds and insects, flight is not denied to quadrupeds. A species of squirrel is provided with two broad membranes, connecting the fore and hind limbs, by means of which it accomplishes leaps resembling short flights. The numerous bats which inhabit every region, enjoy the privilege in the highest extent. We know also that there is a fish which can leave the sea, and support itself for a short time in the air, by the size and action of its fins, forming a substitute for wings. It is chiefly, however, in birds and insects that we find the full exercise of this admirable faculty, which is attained by organs very different in appearance and structure. Indeed, on attending to those of insects, nothing can be more diversified, or, in certain species, more remote from the wings of birds. The bodies of some scarcely bear any proportion to their enormous wings, as in several genera of butterflies; while the wings of grasshoppers, bees, and many species of dipterous or two-winged insects, and beetles, seem incapable of supporting the body. The wings of birds are invariably formed of feathers, long and light, and in general tapering to a point: those of insects consist, in some, of a thin membranaceous substance, covered with scales, which fall off in a powder, or of a reticulated frame, or of thick horny plates conjoined with the thinnest membranes. But all these varieties perform analogous functions, in enabling the animals to accomplish their aërial navigations. Nevertheless, their mode of action is not alike, and great specific gravity is overcome by the rapidity of percussion on the air. Thus, the broad wings of the butterfly, slightly exerted, sustain it as if floating above, while the wings of the humble bee are in the quickest motion during its flight. There is also a considerable variety in the structure of birds, and in their powers of flying. Some, as the kite, the eagle, and the swallow, rise to an incredible height, while the penguin, the ostrich, and the emu, are incapable of elevating themselves from the earth. The penguin is provided only with short feathered stumps; the ostrich has wings which are never employed but to assist it in running; and the texture of the whole plumage of the emu plainly evinces, that it is not formed for flight. It is not a covering of feathers, therefore, that imparts the faculty of aërial transportation; nor is it essential that wings should be composed of light substances.

Mankind have considered it possible to attain this faculty by the aid of artificial wings; and have always resorted to them, in history and fiction, as the primary mode of rising aloft in the air. It is an idea that has been equally indulged by the ancients and the moderns. Dædalus thought to effect his escape from Crete, by the close imitation of nature, as pictured by Ovid.

> Naturamque novat; nam ponit in ordine pennas
> A minima cæptas, longam breviori sequenti:
> At clivo crevisse putes. Sic rustica quondam
> Fistula disparibus paulatim surgit avenis
> Tum lino medias, et cevis alligat imas
> Atque ita compositas parvo curvamine flectit
> *Ut veras imitentur aves.* METAMORPH. lib. 8.

But the ancients went farther than the mere conception of such efforts; for we are told that they constructed machines in the figure of animals, which could actually fly. At the same time it must be acknowledged, that this is rather reported from tradition, than described by spectators, as the wooden pigeon of Archytas, which is alluded to by Aulus Gellius, in these words, "*Sed id quod Archytam Pythagoreum commentum esse atque fecisse traditur: neque minus admirabile neque tamen varium æque videri debet, nam et plerique nobilium Græcorum et Favorinus philosophus memoriarum veterum exsequentissimus affirmatis hinc scripserunt, simulacrum columbæ e ligno ab Archyta, ratione quadam disciplinaque mechanica factum volasse; ita erat scilicet libramentis suspensum et aura spiritus inclusa atque occulta concitum.*" Thus the account is less specific than could be desired of so singular a contrivance; and, although it has been imitated by the moderns, there is the same defective explanation. After Charles V. resigned the crown, various expedients were invented to amuse his leisure hours: among these was the mechanical flight of artificial sparrows, which being allowed to escape from his apartment, performed various evolutions in the air. Before his demission, indeed, it is said that an ingenious mechanic constructed an eagle, which flew from Nuremberg to meet him, on his approach to that city: and the same mechanic is reported to have constructed an iron fly, which having left his hand, flew about, and at length, as if weary, returned to its master. Later mechanics have been content with representing the motions of birds on the earth, but not in flight; though this is perhaps less difficult than may be supposed.

Bishop Wilkins considers, "that there are four several ways whereby this flying in the air hath been or may be attempted, two of them by the strength of other things, and two of them by our own strength. 1. By spirits or angels; 2. By the help of fowls; 3. By wings fastened immediately to the body; 4. By a flying chariot." The first he rejects as not being founded on natural and artificial grounds, and the last we have seen realised in the modern invention of balloons; the second has hardly ever been tried, though the extreme docility of animals might apparently be an encouragement; but the third has excited repeated notice, and the ingenious have endeavoured to reduce it to practice.

The chief and principal obstacle has been found in that law of nature, whereby bodies of greater specific gravity than the fluids wherein they are immersed sink in them; but this proposition is liable to modification, partly resulting from the figure of the body and the motion of the fluid. Rural observers cannot fail to have remarked, that towards autumn the dandelion, a common plant, is covered with a downy substance, continually wafted away by the wind. In a calm it falls to the ground, but in a gentle breeze, it rises high, and advances with steady progression in the air, until it escapes from our sight. On more minute inspection, this substance is discovered to represent a parachute in miniature; the head is feathery, and at the end of the stalk is a seed attached, of far greater specific gravity than the atmosphere. The real down also, which we see floating around us, is of considerable specific gravity; and it is singular that it is not those birds most amply provided with it, nor those of the least specific gravity, that fly the greatest distances. If the feathery substance could be put in motion while the air is at rest, or if an analogous machine, very light, could strike the surrounding atmosphere by any means that could be devised, its rise and progressive motion would be certain.

We read of attempts at artificial flying in various countries and at different intervals, but we are left without information respecting the means employed: it has been conjectured, however, that most of these performances resembled the descent of mountebanks on ropes, from lofty places, secured by a ring or traveller, while the agitation of wings attached to their shoulders broke the force of the fall. Such was the exploit of an Arragonese who, at the coronation of Edward VI. descended a rope compared to a ship's cable stretched from the battlements of St Paul's steeple to the ground, "running on his breast as if it had been an arrow out of a bow." Of the like description were the exhibitions of a juggler on a rope stretched from the top of St Giles's steeple in Edinburgh, and fastened below the cross in 1598. But these feats of address had frequently a fatal termination; as that of another performer from the battlements of St Paul's in the reign of Mary; and as happened at Shrewsbury in the year 1739, where one, who was no mountebank, having successfully performed several tricks on a rope extended from the top of St Mary's steeple, attempted to descend it across the river, when it broke, and he was dashed to pieces by the fall. In the strange pageantry of old, exhibited in these kingdoms and elsewhere, there are repeated allusions to angels, or divinities provided with wings, flying to meet sovereign princes on their triumphal entry into cities; but the mode in which this was accomplished is not described.

During the darker ages, when the possibility of aërial transportation was ascribed to necromancers, Roger Bacon, a man of the most comprehensive genius, speaks of attaining it by wings attached to a machine. In his singular work, *De Mirabili potestate Artis et Naturæ*, he uses the following expressions. *Possunt fieri instrumenta volandi, ut homo sedens in medio instrumenti revolvens aliquod ingenium, per quod alæ artificialiter compositæ aërem verberent ad modum avis volantis.* That is, it is possible to make a flying machine, so that a man sitting in the middle, can, by some expedient, produce a rotatory motion, which shall occasion the percussion of artificial wings on the air like the flight of a bird; and in another passage, he observes, "that a flying machine has undoubtedly been made in our own time, not that I saw it, nor did I know any one who had done so, but I am acquainted with an intelligent person who has conceived such a contrivance." Though the passage is not void of obscurity, by combining it with the former, the author's meaning may be gained. Bacon lived in the thirteenth century. Not far from the same period, and in the succeeding centuries, we are told of a certain monk, Elmerus, who flew above a furlong from the top of a tower in Spain. Another flight was attempted from St Mark's steeple in Venice, and also at Nuremberg; and by means of a pair of wings, a person named Dante of Perouse, was enabled to fly; but while amusing the city with his flight, he fell on the top of St Mary's church and broke his thigh. The subject of aërial navigation received still greater attention in the seventeenth century, as the works of Lana, Hook, and Wilkins testify; and contemporary with them, one Besnier, a locksmith of Sable in France, obtained considerable effect from the aid of four wings. In the only imperfect description of them preserved, they seem to have been four rectangular surfaces, one at the end of each of two rods passing over the shoulders of him who used them, and the posterior two connected by a cord to his ancles. The inventor did not pretend that he could rise from the earth or sustain himself long in the air, from inability to give his apparatus the requisite power and rapidity; but he progressively availed himself of its aid to leap from a window one storey high, next from the second storey, and then from a roof, whereby he passed over the neighbouring houses. By leaving an elevated position, he could cross a river of considerable breadth, or any similar obstacle. His first pair of wings were purchased by M. Baladin of Guibre, who used them with success. This was recently preceding the year 1678; and in the beginning of the next century, Bartholomew Laurence de Guzman, a Portuguese, contrived some strange machine, partly formed with wings like a bird, of which scarcely any intelligible account has been transmitted to us. But while one set of mechanics and philosophers encouraged each other with the hopes of aërial navigation, Borelli, a Neapolitan mathematician, declared that it was impossible for men to fly by their own strength, *fieri non potest ut homines propriis viribus artificiose volare possint*; and perhaps this has been one cause of more attentive investigation into the properties enabling birds to fly, or the methods which might be adopted by men.

As it is neither those which are of the smallest specific gravity, or clothed with the lightest down, that are most capable of flight, it follows that flying is accomplished merely by a mechanical operation; more particularly on considering how much it is diversified among the feathered tribes; one bird is continually soaring aloft at the greatest altitudes, another skims the earth without intermission, while a third only displays its wings occasionally, and is as if propelled by another agent when they open or close. Bishop Wilkins, that ingenious philosopher, whose works are too little studied at the present day, judiciously observes: "We see a great difference betwixt the several quantities of such bodies as are commonly upheld by the air: not only little gnats and flies, but also the eagle and fowls of vaster magnitude." Many insects, even some in this country, exceed the diminutive size of the humming bird, which is but an eighth of an ounce in weight. It is almost constantly on the wing, apparently sipping with its tender bill from the nectarium of the flowers. An enormous bird, the condor of South America, is calculated to be 8162 times heavier: "What an amazing disproportion of weight!" exclaims a modern author; "yet, by the same mechanical use of its wings, the condor can overcome the specific gravity of its body with as much ease as the little humming bird. But this is not all; we are informed that this immense bird possesses a power in its wings so far exceeding what is necessary for its own conveyance through the air, that it can take up and fly away with a whole sheep in its talons, with as much ease as an eagle would carry off, in the same manner, a hare or a rabbit. This we may readily give credit to, from the known fact of our little kestril, and the sparrow hawk, flying off with a partridge, which is nearly three times the weight of either of these rapacious little birds." A calculation is next made of the combined weight of the condor and its prey, which amounts to 20,405 times the weight of the humming bird, to be borne through the air. Probably the author would have found similar illustrations among the more rapacious winged insects, whose wings are less adapted for it. But he proceeds with another comparison, to prove that the length of the wings of birds is not augmented in proportion to the increased weight of their bodies, whence he infers the possibility of constructing a machine with which a man should be enabled to fly. "The condor carries ten stone with wings of 12 feet expansion from tip to tip. The humming bird carries one drachm with three inches expansion; the common wren is three times as heavy as the humming bird, and has but one inch more of wing; a pigeon weighs 16 ounces, which is 256 times as heavy as it is, and has only ten times more expansion of wing; the goat-sucker is 40 times as heavy, and has seven times the length of wing. Therefore, as a man weighing ten stone, and a machine to bear him two, will only exceed the weight of the condor and its prey by one fifth part, and as the wings of the condor are about 12 feet; suppose we make a pair of wings of silk, one fifth longer than they are, which will be about fourteen and a half, I am thoroughly persuaded they will be found amply sufficient, as they will far exceed the progressive increase of birds wings."

Authors have even speculated on the fashion and substance of the wings, and in general have concluded that they should be analogous to those of birds. Bishop Wilkins, after observing that if there be any such artificial contrivances that can fly in the air, then it will clearly follow, that it is possible also for a man to fly himself; and he recommends the wings to be formed of feathers, like those employed by Dædalus, or else of one uninterrupted substance like those of bats. "But now because the arms extended are but weak and easily wearied, therefore the motions by them are like to be but short and slow, answerable, it may be, to the flight of such domestic fowl as are most conversant on the ground; and therefore much more would the arm of a man, as being not naturally designed to such a motion. It were, therefore, worth the enquiry, to consider whether this might not be more probably effected by the labour of the feet, which are naturally more strong and indefatigable. In which contrivance the wings should come down from the shoulders on each side, as in the other; but the motion of them should be from the legs being thrust out and drawn in again, one after another, so as each leg should move both wings, by which means a man should as it were walk or climb up into the air." In all later proposals, however, the idea of flying by exerting the animal powers alone on wings has been abandoned; though the utmost confidence of its success continues still to be entertained, and, as we shall immediately see, it has actually been put in practice. The close imitation of nature, also, under the modification required by the difference of materials, is invariably to be preserved.

Among the most recent authors on this subject, may be named Sir George Cayley, who endeavours to shew that there is nothing adverse to the soundest reasoning in expecting to overcome the difficulties which men experience in elevating themselves in the air. He shews that flight is purely mechanical, for by a simple experiment in disposing four quill-feathers at right angles to each end of a rod, and presenting an oblique surface to the air, this apparatus will of itself rise, when a rotatory motion is produced by the relaxation of a spring untwining a cord connected with it, and encircling the rod. "The flight of a strong man by great muscular strength," he observes, "though a curious and interesting circumstance, in as much as it will probably be the first means of ascertaining this power, and supplying the basis whereon to improve it, would be of little use. I feel perfectly confident, however, that this noble art will soon be brought home to man's general convenience; and that we shall be able to transport ourselves and families, and their goods and chattels, more securely by air than by water, and with a velocity of from 20 to 100 miles per hour." Bishop Wilkins, indeed, was long ago so confident of success, that he anticipated the period when a person should as readily call for his wings to make a journey, as he then did for his boots and his horse. Sir George Cayley continues: "To produce this effect, it is only necessary to have a first mover, which will generate more power in a given time, in proportion to its weight, than the animal system of muscles." He seems to infer, that he has made experiments on a considerable scale; but we are not acquainted with their nature or result; and we are precluded from discussing his theories, by the necessity of referring to what seems more decidedly practical.

Just about the same time, Mr Walker of Hull, whose sentiments we have already quoted, directly proposes a machine whereby flying shall be accomplished; and he maintains that he is the first person who has discovered the real theory of the flight of birds. On considering the structure of birds, he maintains, that by means of a pair of wings and a tail duly expanded in a perfectly passive state, and aloft in the air, without any muscular motion, a bird procures a suspending power, which counteracts the specific gravity of its body, and prevents its being precipitated to the ground. But this is perhaps assuming too much; for it is probable, that although we are not sensible of the action of the wings in birds apparently suspended motionless in the air, they would fall to the earth without it. With respect to the quill-feathers, which are here the prime agents, he observes, that, as they were intended to swim in a fluid so light and subtile as the air, it was necessary they should consist of the lightest materials imaginable; that being intended to strike upon the air with great power and effect, it was requisite that the shafts should possess much strength with elasticity. "It was expedient, too, that the quill-feathers should shut and open, to let the upper air pass through the wings, to facilitate their ascent when they are struck upwards. It was also necessary that they should all shut close together, forming each wing into a complete surface or web, when they are by the muscular power of the bird forced down, in order to give a more secure hold upon the air below, and by their means keep the bird up. Now, if we do but examine the quill-feathers, we shall find in the shafts astonishing strength with elasticity, and very little specific gravity indeed. The webs are broader on one side of the shafts than the other, which causes them to open as the wings move up, and to shut as they come down, exactly answering the purposes I have already mentioned." With regard to the operation and effect of the wings and tail in an active state, it appears that flight is attained from the resistance of the air or percussion. "When a bird, by the power of its pectoral and deltoid muscles, puts its wings into action, and strikes them downwards in a perfectly vertical direction upon the air below, that air, being compressed by the stroke, makes a resistance by its elastic power against the under side of the wings, in proportion to the rapidity of the stroke and the dimensions of the wings, and forces the bird upwards: at the same time, the back edges of the wings being more weak and elastic than the fore edges, they give way to the resisting power of the compressed air which rushes upwards against the same back edges, acting against them with its elastic power, and thereby causes a projectile force which impels the bird forward. And thus we see that by one act of the wings, the bird produces both buoyancy and progression. When the tail is forced upwards, and the wings are in action, the bird ascends; and forced downwards, it consequently descends. But the most important use of the tail is to support the posterior weight of the bird, and to prevent the vacillation of the whole."

Fortified by these principles, Mr Walker proposes an apparatus, whereby, from the action of wings, flying shall be attained; and this is to consist of a case formed of light materials, provided with wings of the requisite dimensions, to be put in action by a man sitting, and as if rowing a boat. The wings are recommended to be each about eight feet long when horizontally expanded; and fastened upon the top edge of the car, with two joints each, so as to admit a vertical motion to the wings, which motion may be effected by a man sitting and working an upright lever in the middle of the car. A tail of seven or eight feet long, and the same breadth at its extremity, must be fixed to the hinder part of the car, and spread out flat to the horizon, in the same manner as we see the tail of birds." Considerable attention must be paid to the structure of the wings and tail, a point that has never escaped speculators on this subject; and Mr Walker proposes that the shafts of each are to consist of six slips of thin whalebone, dressed, and tapering to a point; then wrapped together from end to end in a round form with small twine, and filled with cork along the inside. They are next to be covered with silk very compactly woven, and as impervious to the air as possible. This is to be laid on in separate broad slips, and should open to admit the passage of the air as the wings move up, and close together again as they come down, operating in the same manner as the quill-feathers in the wings of birds. But such a peculiarity may be found unnecessary on experiment, because, as the author observes, "we see flying squirrels, bats, butterflies, flying fish, &c. with wings formed of compact membranes, all flying exceedingly well." It is essential that the car be externally covered with silk or very thin leather, which must be united to the base of the wings along each side of the car, to prevent, as much as possible, the air from escaping any where but from the back edges of the wings. Should that be neglected, when the air is compressed by the wings being struck downwards, it will rush upwards through the car, and thereby fail of giving that resistance against the under side of the wings, which is necessary to give buoyancy and progression. The whole is to be considered "as a large artificial bird, and the man placed in the inside as the vital or moving power." Such is the flying machine by which Mr Walker expects to accomplish a journey to the ethereal regions. In studying its operation, he particularly directs our attention to the propulsion occasioned by the reaction of the air against the under side and back edges of the wings. "When the air is struck by the wings, the effect of its reaction against their under side and back edges is similar to that which is caused by the wind blowing with sufficient force against a mill sail when it rushes off on one side, and impels the sail to move, with this difference only, that the sail, being fastened at one end of an axis, is made to revolve; whilst the bird, being at full liberty in the air, is caused, by the expansive power of the air acting with a resisting force against the back edges of the wings, to glide forward in a right line." We shall abstain from following the author in his details respecting the manner in which the aërial navigator is to commence his flight; how he is to clear the tops of houses, trees, and hills; with safety; and how he is to guide himself through the subtile fluids floating high above the earth: but he is no less confident than Sir George Cayley, of the speed of his journey; and in answer to any objections against the utility of flying, he says, "I hope it will be granted, that flying will be of great use, if by such means we can have our letters, newspapers, &c. conveyed to any part of the kingdom, at the rate of 40 or 50 miles in an hour: or if that numerous class of mercantile agents, riders, henceforth be enabled to glide through the air with great expedition in flying machines: or if a man by such means can take a rope to any mariners in distress along the sea-coast, and thereby be the happy instrument of saving their lives: and if the circumnavigator be able to quit his ship, fly, and explore the interior parts of a new-discovered island, free from the annoyance and hostilities of its rude inhabitants."

The expectations of these authors would certainly not be disappointed, could the flight of man, if it be attainable, approach the speed of the feathered tribes. Birds dart through the air; the eye can scarcely follow them; and the largest can almost instantaneously seek those points and altitudes, where they are lost to human vision. Some conjectures have been formed of the rate of this extraordinary velocity. Sir George Cayley computes the flight of the common crow at 34½ feet in a second, or above 25 miles an hour. Mr Cartwright calculated the flight of wild ducks on the coast of Labrador, at 90 miles an hour. Spallanzani, by actual experiment, found that a swallow flew 20 miles in 13 minutes, or at the rate of 92 miles an hour; but he conceives, that the swift or martin can traverse no less than 60 miles in 15 minutes.

It appears, that in the year 1808 or 1809, Mr Degen, a watchmaker of Vienna, actually realised the views of the numerous projectors who preceded him, regarding the flight of men in the air. We regret that we cannot present a description of his machine in detail; but it seems constructed on philosophical principles, and to operate in a manner analogous to the wings of birds; while the effect partly resembles the closing of a parachute stationary on its descent. A frame is made, principally consisting of rods of some strong but light materials, on which the adventurer stands in an erect posture. A heart-shaped wing, nine feet long, eight broad at the swell, and terminating in a point, proceeds from that part of the frame close to each shoulder; and a fan-shaped tail, apparently connected with both wings, proceeds from behind as far as their swell. Each wing is concave like a parachute, and, by a series of cords from the extremity of the different ribs composing it, can be suddenly contracted, so as to give percussion against the air, and consequently by its resistance produce elevation. It is not sufficiently explained how the working of the machine is effected; but it is to be inferred, that this is done by elevating, depressing, or revolving a crank, connected at each extremity with the series of cords, which display or contract the wings. M. Degen is said to have mounted high in the air by the aid of his machine, and to have exhibited a flight resembling that of a bird, not consisting merely in ascent or descent, but in real aërial navigation.

We are hence entitled to conclude, that the elevation of man in the atmosphere by artificial wings, is not beyond the bounds of possibility. Without indulging in fanciful theories, could it be reduced to practice, it assuredly would not be void of utility. The reason why the invention of balloons has not hitherto been eminently beneficial, arises from their unwieldy size, which is an obstacle almost insuperable to guiding them, and which leaves them at the mercy of the winds. It might be otherwise on the employment of wings, for a narrower proportion could be preserved between an oar or a rudder, of whatever kind or description, and the total volume of the machine, than between the same implements and an inflated balloon. Birds, however, present some physical peculiarities, which man can never hope to imitate: their muscular powers, their corporeal structure, and above all, their mode of respiration, are of a different nature from what is witnessed among terrestrial animals. Hence it is not unlikely that the highest perfection of artificial flight would only be a distant approach to the admirable prerogative which has been conferred on the feathered tribes. See Aulus Gellius, lib. x. cap. 12. *Journal des Savans*, 1678, p. 235. Wilkin's *Mathematical Magic*. *Archæologia*, vol. vii. Holinshed's *Chronicle*, vol. iii. p. 1121. Walker's *Treatise on Artificial Flying*. Sir George Cayley on *Aërial Navigation*, in *Nicholson's Journal*, vol. xxiv. *Annales des Arts et Manufactures*, tom. xxxi. Huber, *Sur le Vol des oiseaux de proie*. (c)

FO. See CHINA, vol. vi. p. 243.

FO-PEE. See CHINA, vol. vi. p. 219.

FOCHABERS, is the name of a small town in the county of Moray, situated on the right bank of the river Spey, a few miles above its mouth. The town stands on a rising ground above the river, and consists of a square with streets entering it at right angles. The houses are neat and well built, and the church, situated on the south side of the square, is a handsome building. A very large and elegant bridge, built of freestone, and consisting of four circular arches, was lately thrown over the Spey at this town. The two middle arches have a span of 95 feet, and the other two a span of 75 feet. It was completed in 1804, at the expence of £14,880. Gordon Castle, the beautiful and splendid mansion of the Duke of Gordon, is contiguous to the town. The body of the castle is four stories high, and at each end is a pavilion of two stories, connected with the body by a gallery of two lower stories. The whole length of the front is 568 feet. In the middle of the southern side of the building is preserved an old tower 90 feet high, built in the 10th or 11th century. The population of Fochabers is about 1000, and the town is in a very thriving state. See *An Account of the Antiquities, &c. of the Province of Moray.* (*j*)

FOCUS. See ASTRONOMY, CONIC SECTIONS, and OPTICS.

FOG. See METEOROLOGY.

FOGGIA, a town of Naples, in the province of Capitanata. In consequence of the destruction of the old town by an earthquake in 1732, the present town was built with great regularity and neatness. The houses are well built with white stone, and the streets are good. The granaries, in which the corn is preserved, are built beneath the streets and squares; the sides within being faced with stone, and the orifices closed with earth and stones. On account of the insalubrity of the climate, the town is in a great measure deserted in summer, but in winter it is supposed to contain about 20,000 inhabitants. (*j*)

FOLKSTONE, the *Lapis Populi* of the Romans, and the *Folcestane* of the Saxons, is a seaport town of England in the county of Kent. It is situated on unequal ground near the sea, and consists of three irregular streets, built chiefly on the acclivity of a hill. The houses, many of which are good, are principally built of brick. The church, which stands directly on the cliff above the town, is dedicated to St Mary and St Eauswith. It is built in the form of a cross, with a tower rising from the intersections, supported on very large piers, from which spring pointed arches, with plain mouldings. The market-house has been recently built at the expence of the Earl of Radnor. A free school was founded here in 1674, for 20 poor children. The Baptists, Quakers, and Methodists, have each a meeting-house in the town. There is also a custom-house at Folkstone, and a battery mounting six heavy guns.

Folkstone enjoys a good coasting trade, and ship-building is carried on here to a considerable extent. The inhabitants are, however, principally employed in fishing. The fish is of a superior kind, and consists of mackerel, herrings, soles, whitings, conger eels, plaice, skate, &c. The harbour was small, and preserved principally by jetties; but it has recently been much improved. Before the town there is good anchorage, with eight or ten fathoms of water. Folkstone is a member of the cinque ports, and is governed by a mayor, 12 jurats, and 24 common councilmen, &c. This town was formerly very large, containing 5 parish churches; but the greater part of it has been carried off by the sea. About a mile and a half to the north of Folkstone, on the top of a high hill, is an ancient camp, comprehending nearly two acres. The small bathing village of Sandgate, is about a mile and a half west of Folkstone. A large martello tower has been erected in the centre of the castle of Sandgate; and at Shorn Cliffe, on the hill above Sandgate, an extensive range of barracks has been recently built. In the year 1811, there were in the town of Folkstone,

Inhabited houses	765
Families	841
Do. employed in agriculture	23
Do. in trade	157
Males	1673
Females	2024
Total population	3697

See the *Beauties of England and Wales*, vol. viii. p. 1106, and Hasted's *History of Kent.* (*w*)

FONDI. See FUNDI.

FONTAINEBLEAU is a town of France, in the department of the Seine and Marne. It is beautifully situated in the forest of the same name, and consists of a principal street, with several smaller ones. Fontainebleau is chiefly celebrated for its royal palace, which is built at the south end of the town. In its external appearance it is very ugly and irregular, having been erected at different times. It consists indeed of four distinct chateaus, each of which has a garden, and contains no fewer than about 900 apartments, most of which are fitted up in the most splendid style. The apartments in which the Pope was detained by Bonaparte; the small room, in which Bonaparte himself abdicated the throne of France; and the bedroom in which he slept before he set off for Elba, are now shewn with great interest to travellers. The gallery of Francis I. contains 26 busts of eminent men upon marble pillars. Among these, the writer of this article observed Alexander the Great, Demosthenes, Cicero, Gustavus Adolphus, Duke of Marlborough, Washington, Colbert, L'Hospital, and a great number of Bonaparte's aides de camps. A large bust of General Dessaix presided at one end of the room. The chapel is extremely beautiful, the floor being variegated with the finest marble; but it had not received any repairs since the revolution. The theatre is remarkably elegant, being adorned with blue and gold. In the middle of a large piece of water stands the pavilion of Louis XIV. Several pieces of water are seen from the palace, and some fine wooded hills, but there is nothing very remarkable about the grounds. The front of the palace, which is opposite to the town, is inclosed with a lofty iron railing, each rail being in the form of a spear with a gilt top, a form which is adopted at all the palaces of Bonaparte.

The forest of Fontainebleau is almost round, and contains about 25,000 acres. It covers several small hills and plains, and the surface of these hills is covered with large insulated stones, which have the appearance of being thrown there by accident. Many fine trees in the forest are in a state of complete decay. Population of the town 9000. (*j*)

FONTAINE, JOHN DE LA, a celebrated French poet, and one of the most original writers of that nation, was born at Chateau-Thierry, in the year 1621. He received a liberal education, but discovered no peculiar talent for poetry until his twenty-second year; at which period his latent powers are said to have been kindled by the perusal of some of the odes of Malesherbes. His first essays he was in the habit of submitting to the judgment of a relation of his own, who encouraged him to proceed, and frequently used to read with him Quintilian, Horace, and the best Roman authors. La Fontaine also endeavoured to improve his genius, by an acquaintance with the French and Italian writers; and, from the works of the most eminent Greeks authors, he drew many of those fine moral and political maxims, which he has interspersed among his fables.

A desire of enjoying the conversation of men of letters induced him to remove to Paris, where the intendant, Fouquet, soon procured him a pension. He was afterwards appointed gentleman to the Queen Henrietta of England; but the early death of that unfortunate princess put an end to all his hopes of court preferment.

Some time after that event, the generous and witty Madame de la Sabliere invited him to reside in her house, offering to provide him with an apartment and all necessaries. The invitation was accepted; and he soon became so domesticated in his new residence, that the lady, having once in a pet turned away all her servants, observed, that she had kept only her three animals,—her dog, her cat, and La Fontaine.

La Fontaine does not appear to have possessed any share of that lively sensibility, which has generally been considered as characteristic of the poetic tribe; on the contrary, he seems to have been gifted with a very extraordinary degree of apathy and indifference. In his conduct and behaviour, he was plain, artless, easy, open, and credulous; he displayed no envy or ambition; he never took umbrage at any thing that was said or done; and he lived long in habits of the most cordial intimacy with the most celebrated wits of Paris. He made no figure in company, but frequently exposed himself to ridicule, in consequence of his awkwardness and absence of mind.

Upon the death of Madame de la Sabliere, with whom he had lived upwards of twenty years, he is said to have received very flattering invitations from several of the English nobility; but he was induced to decline them, in consequence of the liberality of the Duke of Burgundy, and the emulation excited among his own countrymen by the generous invitation of the English lords.

Although far from being either an infidel or a libertine, La Fontaine had lived in extreme carelessness with regard to religious concerns. However, when in 1692 he was seized with a dangerous illness, the priest who attended him is said to have prevailed upon him to suppress a dramatic piece, which was just going to be offered for representation, and to make a solemn apology, or palinode, in presence of a deputation of the members of the academy, for the publication of his tales. The singularity of his appearance and habits was such as to pass for stupidity among the vulgar, or with those who were not intimately acquainted with his character. The nurse, who attended him during his illness, observing the fervour of the priest in his exhortations to the sick man, exclaimed: "Ah! my good Sir, don't plague him so; he is rather stupid than wicked." He died at Paris in the year 1695.

La Fontaine is generally accounted one of the most original writers of France. His fables are esteemed as master-pieces in that species of composition, and stand unrivalled by any writer of his own, or of any other country. Ingenious thoughts are there unfolded with admirable clearness and simplicity, clothed in language at once easy and graceful, and adorned with all the charms of a brilliant versification, while the most profound moral maxims and reflections are delivered in a style divested of dogmatism, and seem to arise naturally, and without effort, out of the narrative.

His tales, which are borrowed for the most part from the Italian novelists and romance writers, are related with great humour and vivacity; but it is to be regretted, that the subjects in general are such as admit of no moral application; and which no art can divest of a colouring offensive to delicacy. (z)

FONTARABIA, or *Fuenta Rabia* in Spanish, and *Fons rapidus* in Latin, is a town of Spain in the district of Guipiscoa. It was formerly called *Ocaso.* It is situated in a small peninsula on the sea coast, on the left bank of the Bidassoa, and the town is built in the form of an amphitheatre, on a hill, which looks to the sea, on the south angle of the Gulf of Gascony. It is well fortified both by nature and art, being defended by a strong fortress towards the sea, and on the land side by the high mountains of Jasquevel. The harbour would be good were it not left dry by the tide. Its position, according to trigonometrical observations, is, West Long. 1° 47′ 15″, North Lat. 43° 21′ 36″. See Laborde's *View of Spain*, vol. ii. p. 349. (j)

FONTENELLE, Bernard le Bouvier de, a French author of considerable celebrity, was born at Rouen, in the month of February 1657. His mother was a sister of the famous Corneille; from whom he may be supposed to have inherited some portion of that literary genius for which he was distinguished.

Fontenelle acquired the rudiments of learning at the school of the Jesuits at Rouen; and at the age of thirteen, he produced a successful Latin prize-poem on the subject of the immaculate conception. At fifteen, he had completed his course of studies. His father intended that he should embrace the profession of the law, which he himself had prosecuted with success; and Fontenelle actually pleaded a cause before the parliament of Rouen. But the discipline and habits of the legal profession were not congenial with his easy and indolent disposition; he resolved, therefore, to abandon these pursuits, and to devote himself entirely to literature. With this view, he accompanied his uncle, Thomas Corneille, to Paris; and commenced his literary career by the production of a tragedy, which, however, was unsuccessful upon the stage. But he bore the disappointment without murmuring; and undismayed at the result of his first attempt, he turned his attention towards other subjects, in which he was better qualified to excel.

The first production which contributed to bring him into notice as an author, was his *Dialogues of the Dead;* which, although written in an affected style, and objectionable in many respects, acquired considerable popularity. His *Letters of the Chevalier d'Her**** are much inferior to those of Voiture, and might have been suppressed without any injury to his reputation; indeed, he never expressly avowed himself the author of these letters. In his *Eclogues* he departed from the peculiar style and character of that species of writing, and introduced ingenious thoughts and fine allusions, remote from the simplicity of pastoral life.

The two works of Fontenelle which contributed most to establish the reputation of his literary character were, his *Plurality of Worlds,* and his treatise *on Oracles.* The ground-work of both of these treatises was borrowed; but his luminous and methodical genius gave clearness to subjects that were previously involved in obscurity; while the graces of his style, sometimes perhaps a little too brilliant and flowery, rendered the principles of the abstract sciences acceptable to general readers, by bringing them down to the level of ordinary understandings.

Fontenelle appears to have had a great desire to distinguish himself as a writer for the stage; and after having failed to obtain the success he expected from his tragedy, he attempted the composition of operas; but of all his dramatic productions, the opera of Peleus and Thetis, which was first represented in 1689, is the only one which had merit sufficient to preserve it from oblivion.

While yet a young man, he took an active part in the controversy which then agitated the literary world, respecting the comparative merit of the ancients and the moderns. Fontenelle declared himself an advocate for the latter; and his conduct in this dispute is thought to have proved an obstacle, for some time, to his admission into the Academy,—an honour which he at length obtained in the year 1691. During a period of nearly 66 years, he contributed to support the celebrity of that illustrious body, by the propriety of his moral conduct, and the splendour of his literary character. He was also admitted a member of the Academy of Sciences in 1697; and two years afterwards, when the constitution of that learned society underwent some change, he was clothed with the title of perpetual secretary, and became one of its most active associates. His history of the Academy of Sciences, and the *eloges* which he pronounced upon several of the most eminent academicians, afford ample proofs of his talents and acquirements, and of his zeal for the interests of learning. He embraced the principles of Descartes; and continued faithful to the theory of *vortices*, after the introduction of the Newtonian system had deprived it of almost all its adherents.

Fontenelle died at Paris in the year 1757, having lived nearly one hundred years. For this uncommon longevity, he appears to have been indebted to a very extraordinary constitution of body and of mind. At his birth, he was thought so extremely delicate, that doubts were entertained whether he should live. In his youth, he avoided every kind of bodily and mental fatigue; abstained from every sort of diversion that demanded an effort of strength, and spent the whole course of his life in a series of studies and pleasures equally tranquil. His mental constitution was no less singular. He seemed totally divested of passion; was never irritated by censure, nor elevated by praise; never transported by joy, nor depressed by grief; and he is said to have never laughed nor wept. If this constitution deprived him of some pleasures, it also preserved him from many evils; and it enabled him to attain an extreme old age, without suffering much from the infirmities incident to that period of human life. (z)

FONTENOY. See BRITAIN, p. 627.

FOOD. See ALIMENTS.

FOOT. See MEASURES.

FORCES. See DYNAMICS and MECHANICS.

FORESTAFF, the name of a clumsy instrument long ago exploded, for taking the altitudes of the heavenly bodies at sea.

FORFAR-SHIRE, one of the maritime counties of Scotland.

1. *Natural History.*—The county of Forfar, known also by the name of *Angus*, is situated on the east coast of Scotland, immediately to the north of the estuary of the Tay, between 56° 27′ and 56° 59′ of North Latitude, and between 0° 14′ west, and 0° 46′ east of the meridian of Edinburgh. It is bounded on the south-west and west by the county of Perth; on the north-west by Aberdeenshire; on the north-east by Kincardineshire; on the south-east by the German Ocean, and on the south by the Frith of Tay. The line by which it is divided from Perthshire is very uneven, and extends from Kingudie, to the westward of Dundee, in a northerly direction to the source of the Isla. The division between this county and Aberdeenshire is chiefly marked by the *Water shed*; the ground containing rivulets running northward to the Dee belonging to the latter, and the ground with rivulets running southward into the Esk or the Isla to the former. The North Esk divides the lower part of the shire from Kincardine. It contains 977.97 English square miles, or 496,230 Scottish acres.

Situation.

Climate.

This county, possessing both maritime, inland, and alpine districts, has every variety of aspect and climate. In the high grounds, among the Grampian mountains, where the snow is seldom long absent even in the summer months, the air is cold and piercing. In the inland districts, the climate is mild and genial; and the same might be said of the places along the coast, were they not occasionally visited with easterly breezes, previously chilled by the cold of Scandinavia. Several registers of the weather have been kept in different places in this county, in which the quantity of rain, and the state of the barometer and thermometer have been recorded with accuracy. One of these registers kept at Belmont, in Strathmore, twelve miles north-west from Dundee, and two miles distant from any eminence, indicated the following quantities of rain, in inches and decimals, during six years.

In the year	1790	31.4
	1791	37.1
	1792	38.4
	1793	39.5
	1794	39.
	1795	36.6

During the three first years of the preceding period, the following appears to have been the state of the barometer and thermometer:

		Inches.
Mean height of the barom. in the year	1790	29.59
	1791	29.61
	1792	29.59
Mean height of Fahrenheit's thermom.	1790	41°
	1791	42
	1792	42

Another register kept at the Crescent, half a mile west from Dundee, on the banks of the Tay, and 40 feet above its surface, indicated by the rain-gauge and thermometer as follows.

	Rain Inches.	Thermometer
1790	22.27	51°.
1791	24.8	48.5
1792	34.12	48.
1793	28.13	49.
1794	30.44	52.
1795	29.	46.

Springs.

Although there are many springs in this county, none of them can be considered as remarkable, either for the quantity of water which they discharge, or the mineral substances which they hold in solution. A few springs of the chalybeate kind are resorted to by persons labouring under diseases arising from debility of the organs of digestion. The principal springs are, one in the neighbourhood of Montrose; another at Wormy hills, to the south-west of Aberbrothick; and a third at Dumbarrow, in the parish of Dunichen.

Lakes.

Formerly there were few parishes in which lakes did not exist; now the number of these is greatly reduced. A few have been drained, in order to increase the extent of the arable ground; but by far the greatest number, containing fine shell-marl at the bottom, have been drained, in order to obtain that valuable manure. The lake called Lentrathen loch, situated amidst the Grampians, and in the neighbourhood of most magnificent scenery, is nearly of a circular form, about a mile in diameter, and yields to the botanist several rare plants. Loch Lee, another of the Grampian lakes, is about a mile in length, and a quarter of a mile in breadth. In the more level parts of the county, we meet with the lakes of Forfar and Roscobie; and among the Sidlaw hills, those of Lundie, Balshardy, and Pittendreich. These are well stored with trout, pike, perch, and eel.

Rivers.

The principal rivers in this county, or *waters* as they are provincially termed, are, 1. The *North Esk*. This river takes its rise from Lochlee, whose waters are supplied by many small streams, which flow from the neighbouring mountains. It descends from the high grounds with considerable rapidity, and, after having been joined by several small streams, as the Mark, the Tarf, the West Water, and the water of Cruick, it empties itself into the German Ocean, about three miles north-east of Montrose. 2. The *South Esk* likewise has its rise from a small lake arising among the Grampians, fed by the mountain-streams of Clova. Descending from the Grampians, it receives several subordinate streams, and, after passing by Brechin, empties itself into the basin at Montrose. 3. The *Isla* is another of the streams which rise in the Grampian mountains. Its channel is deep, and in the course of its descent exhibits many fine cascades. In the low grounds its motion becomes less rapid, until it falls into the river Tay in Perthshire. The streams called the Dean, the Lunan, the Dichty, and the Brotheck, are too inconsiderable to be ranked as rivers.

Hills and vallies.

The surface of this district is greatly diversified in its appearance. On its northern and western limits, the Grampian mountains rise in lofty grandeur, and exhibit all the varied scenery of an alpine country. They are here termed the *Braes of Angus*, and in some places possess an elevation of nearly 3000 feet. To the south of the base of the Grampians, and at the distance of four or five miles, another range of hills appears, with a character less bold and majestic, known by the name of the Sidlaw hills. These are to be considered as a continuation of the Ochils, as they are composed of the same materials, observe the same direction, and exhibit, with these, an almost uninterrupted continuity. This range does not greatly exceed 1000 feet in height above the Tay. It traverses the whole extent of the county from Montrose to Lundie. Amidst the Grampian mountains, and even among the Sidlaw hills, there are numerous vallies, which add beauty to the scenery, and give fertility to the district. But these vallies appear as nothing, when compared with that extensive plain situated between the Grampians on the one hand, and the Sidlaw hills on the other, called *Strathmore*, and sometimes termed by the natives the *How* of Angus. This great valley runs parallel with the Grampians from their commencement in Dunbartonshire, to their termination on the borders of Aberdeenshire. This great valley, in which the hand of the manufacturer will ere long dig a canal, and spread the sail of commerce, is scarcely elevated 200 feet above the level of the sea. It would appear from the stratified hills of gravel which here and there appear, and from all the other phenomena of the valley, that it was the basin of an extensive lake, fed probably by many of those streams which at present flow through other districts, owing to the changes which the Grampians have undergone by the hand of time.

ralogy.

The county of Angus presents to the mineralogist a fine field for the display of his powers of investigating nature. No less than four classes of rocks make their appearance: The primitive, the transition, the flœtz, and the alluvial.

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The rocks of the primitive class are granite in small portions, gneiss, mica slate, and clay slate. The *granite* presents several varieties, with respect to the size of the grain, and the colour of the felspar. In some instances it is fine-grained, and bears a close resemblance to the granite of Aberdeen. The variety termed *Pierre graphique*, and a still more uncommon variety, in which the felspar assumed a rose colour, were observed by Colonel Imrie. This granite occupies the centre of the Grampians, and appears to be the fundamental rock. It contains rock crystal, called *Cairngorum*, and topaz. *Gneiss* is a very prevalent rock in this district. It rests upon the granite, and is fine-grained, compact in its texture, and usually of a grey colour. It contains in several places beds of hornblende rock. *Mica slate* is by far the most abundant rock. The mica which it contains is termed *sheep's siller*. It seldom contains garnets. *Granular limestone* is by no means of rare occurrence; and were the Highlanders disposed to burn it, they would soon improve their pastures. Peat is at hand, and answers well as fuel for the purpose. *Clay slate* occurs in the less elevated districts; but in these strata no good beds of roof slate have as yet been discovered, owing probably to want of skill and industry. These primitive rocks are traversed by veins of porphyry, consisting of a basis of compact felspar, with crystals of felspar, and grains of quartz. These veins are from 8 to 10 feet in breadth, and although occurring at considerable distance from one another, yet they all observe the same direction. They stretch nearly from south to north. Lead glance has also been found in veins among these rocks. It was formerly wrought to a considerable extent near the old castle of Innermark, and yielded a sixty-fourth part of silver.

Mineralogy.

Transition rocks.

In descending from the Grampians towards the valley of Strathmore, the *transition rocks* make their appearance. They consist of *grey wacke slate*, in which the shistose character is more or less distinct, and the imbedded grains of quartz more or less numerous. In this slate numerous elliptical masses of jasper occur, in some cases extending to 30 feet in length, and 10 in breadth. The slate likewise contains nests of *slate spar*. *Compact felspar* occurs in beds of considerable magnitude, of a reddish brown colour, and a concheidal fracture. Several varieties of trap rocks also present themselves, under the forms of greenstone and basalt. *Limestone* also occurs of a darker colour, of a less crystalline structure than the primitive limestones, and is much traversed by veins of quartz and limespar. The older members of this formation alternate with the newer portions of the primitive class, and constitute the fundamental rock of the flœtz class, which we are now to consider.

Flœtz rocks.

The flœtz rocks of this district, although they present great variety of composition, may all be referred to the old red sandstone formation of Werner, as red sandstone is the prevailing rock. The *red sandstone* is, in some cases, fine grained, and answers for architectural purposes; and, in other instances, it passes into *gravelstone*, or a rock composed of water-worn pieces of the more ancient strata, imbedded in a basis of sandstone, or ferruginous clay. The sandstone is frequently in the form of slates, or flags, and is much used for the roofing of houses and pavement. *Limestone* is likewise common in this district, and in several places is quarried, and burnt for economical purposes. It is commonly in the form of limestone conglomerate, a condition which appears peculiar to the limestones of the old red sandstone formation. Besides these rocks, there are extensive beds of *trap*, provincially termed *scurdie*, under the form of greenstone, basalt, amygdaloid, wacce, clinkstone, felspar, and porphyry. These rocks are traversed by veins of limespar and heavy spar, and frequently contain traces of *copper ores*. These flœtz rocks rest upon those of the transition class; and, at their southern extremity in Fife, support the strata of the coal formation.

Alluvial strata.

The alluvial strata, as may be expected from the variety of surface, are very different in appearance and composition. On the summit of the Grampians, there is either a light gravelly soil formed from the decay of the primitive rocks, or the moisture of the air in those ele-

FORFAR, a royal borough, the capital of the county of Angus or Forfar, stands in the great valley of Strathmore, of which it commands a very rich and extensive view to the west; and the prospect is terminated by the Sidlaw and Grampian mountains, some of which may not be less than 50 miles distant. In all writings respecting the patronage, tithes, &c. the parish is designed *Forfar Restenet*. The latter is the name of a priory, two miles distant from the town, and formerly surrounded by a lake, which is now drained; the name of which is supposed to be expressive of the purpose for which it was built, viz. as a safe repository for the charters of the monastery of Jedburgh.

In ancient times, Forfar was honoured with the residence of majesty. The ruins of a palace, or castle, are still to be seen on the top of a mount, which rises about 50 feet above the level of the plain. Here Malcolm Canmore held his first parliament, in the year 1057, immediately after the recovery of his kingdom from the usurpation of Macbeth. A figure of the castle, cut in stone, forms the device of the seal of the borough, though nothing but rubbish now remains on the spot where it once stood. The lake of Forfar, formerly stretching two miles in length from east to west, and half a mile in breadth, and covering the palace on the north, afforded a plentiful supply of water, and added to the strength of the place. About 50 years ago, this lake was drained of 16 feet perpendicular depth of water, by which a very great quantity of moss and marl has been gained yearly. About a mile in length, and a quarter of a mile in breadth, of various depth, from 2 to 22 feet, still remains, and adds much to the beauty of the town. This lake proved fatal to the murderers of Malcolm II. in the year 1036. Having perpetrated the bloody deed in the castle of Glammis, about five miles distant, they attempted to cross the lake upon the ice, which gave way under them, and they all perished. Their bodies were afterwards found; and it being ascertained that they were the murderers of the king, they were hung on gibbets by the highway.

During the usurpation of Cromwell, a detachment of his forces pillaged the town, and burnt all its public records. By that wanton deed, every written memorial of its antiquities perished. The only charter which the town now possesses, is one granted by Charles II. after his restoration, confirming all its former rights and privileges. One melancholy evidence, however, of the ignorance and superstition of the times, still remains. From the record of trials, it appears, that nine women were condemned and burnt here for witchcraft betwixt the year 1650 and 1662. The *witch-bridle*, as it is called, by which they were led to execution, is still preserved. It is made of iron, in the shape of a dog's collar, with two pikes on the inside. The pikes were put into the mouth, and the collar tightly buckled round the head. To the collar is affixed an iron chain, by which the unhappy sufferers were conducted to a field adjoining to the town, which is still pointed out as the place of their execution. Another remarkable fact in the history of this borough, is, that it obtained an act of the Scottish parliament, in the reign of James VI. changing the weekly market-day from *Sunday* to Friday. At what time it was changed from Friday to Saturday, is not known.

The borough is governed by a provost, two bailies, twelve councillors, and four deacons of crafts, who represent their respective corporations. All are chosen annually, and the council thus constituted consists of nineteen members. In order to the election of these office-bearers for the year, some days before Michaelmas each magistrate names five burgesses, who, with the four new deacons of craft elect, make up the number of nineteen additional electors; and by these thirty-eight the new magistrates and council are chosen. It may, and often does happen, that the number of electors falls short of thirty-eight, or twice nineteen; because, if any of the old members die before the end of the year, and if one or more of the old deacons be re-elected, there are no substitutes for them on the new list. But if all the old nineteen be alive, and if four new deacons be elected, the number of electors must, by what is called the *set* of the borough, amount to thirty-eight. The twelve councillors may be annually re-elected; the provost and bailies too may thus be members of council for life. None of them, however, can be elected to the office of magistracy oftener than three successive years in one series. But, after having been one year out of office, and returning to the rank of common councillor, or private citizen, each may be re-elected for a new series of three successive years.

The council has the privilege, in conjunction with the town councils of Dundee, Perth, St Andrews, and Cupar in Fife, of electing a representative in parliament. The revenue of the borough is from £800 to £1000. It is the seat of a presbytery, and of the courts of justice; and the place where the freeholders and commissioners of supply meet for transacting the business of the county. On a muir adjoining to the town, several fairs are held throughout the year, which are well frequented; the *custom* of which was many years ago purchased by the town council from the Earl of Strathmore. From Martinmas to Candlemas, a weekly market, free of custom, is held on the street every Wednesday, for the sale of fat cattle; and during the seed time there is one weekly, on the same day, for the sale of work horses. These tend to increase the revenue of the borough, while they afford much accommodation and benefit to the surrounding neighbourhood.

Manufactures have in this town kept pace with their progressive improvement in every other town in the county. About the year 1745, the manufacture of Osnaburgh, or brown linen, was introduced. From a very small beginning, it has grown into a considerable trade, is now the staple manufacture, and for many years past has contributed greatly to the prosperity and rapid increase of the population of the town. The history of the introduction of this manufacture is curious. It was brought to Forfar by a gentleman, who afterwards acquired by it a comfortable independence. His brother, a weaver in Arbroath, about the year 1738, having got a small quantity of flax, unfit for the kind of cloth then usually brought to market, made it into a web, and offered it to his merchant as a piece on which he was willing to lose. The merchant, who had been in Germany, instantly remarked the similarity betwixt it and the fabric of Osnaburg, and with difficulty prevailed upon the weaver to attempt other pieces of the same kind. The experiment, however, succeeded to his wish; and a company was soon afterwards established at Arbroath, for the purpose of conducting the new manufacture, from whence the discovery was brought to Forfar. Of late years, Osnaburgs, of the best quality, denominated Strelitz, have been manufactured for the London market, with sheetings of all breadths, British duck, Germans, &c. The quantity about 2,500,000 yards annually, the average value of which may be estimated considerably above £100,000.

Forfar has been long celebrated for brewing good beer. About twelve years ago, one establishment was formed, and afterwards another, for brewing porter.

These have succeeded well. For two or three years past, indeed, on account of the high price of barley, less business has been done than for years preceding. But now, when grain is likely to assume a fair medium price, it may reasonably be expected that those breweries will extend their trade, as formerly, beyond the supply of the town and its immediate neighbourhood.

Various other improvements have of late years been carried on, which have contributed to the embellishment of the town, while they evince the public spirit of the inhabitants. Among these we may mention a botanic garden, the work of the late Mr George Don, who was well known, and justly celebrated in the botanic world.[*] One of his sons is said to inherit his genius, which had also received some culture under his care. The garden is replenished with a great variety of rare indigenous and foreign plants. A nursery, too, of about nine acres, under the care of an intelligent and active proprietor, is an ornament to the town, and promises to be extensively useful to planters, being filled with all kinds of fruit and forest trees, and situated in the middle of a rich and improving country. A large and commodious church, on an elevated situation, was built in 1790, which accommodates from 2000 to 3000 hearers; and last year (1814) it was ornamented with a steeple 150 feet high, which arrests the eye of the traveller in every direction, and is deservedly admired as a very elegant structure. The population of the town and country parish is about 5600. A small society of Scottish Episcopalians, and another of Antiburgher Seceders, form the only dissenters; and it is worthy of being recorded, that not fewer than 2100 annually partake of the Lord's supper in the established church. There are three public schools; two endowed by the magistrates and council, and one by them and the heritors of the parish. They are now to be placed in systematic arrangement, under the care of one of the teachers as rector; and accommodated with a suit of new apartments, which will form an additional ornament to the borough, and exhibit an additional proof of the good taste and public spirit of the managers of the public funds.

Forfar, from its inland situation, fifteen miles from the coast, is subject to many disadvantages; but if a canal to Arbroath, some years ago projected, shall open an easy and cheap access to the sea, it may rise to a degree of prosperity which it has not hitherto attained. (A. F.)

FORFEITURE. See LAW.

FORGE. See IRON.

FORMIC ACID. See CHEMISTRY, p. 60.

FORMOSA, called by the Chinese *Tai-ouan*,[†] and by the natives *Kaboski* and *Gadavia*, is an island subject to China, lying between 22° and 25° North Lat. and between 3° and 5° East Long. from Pekin. It is situated about 30 leagues from the coast of the province of Fokien; and is above 80 leagues in length from north to south, and nearly 28 in breadth from east to west. Though lying within so short a distance of the continent, it does not appear to have been known to the Chinese till the year 1430, nor for many years afterwards did they avail themselves of the discovery. It was merely visited in 1564, by the commander of one of their squadrons, when he subdued the little islands of Pongho, which lie about midway between it and China. In 1582, a Spanish ship sailing from Macao to Japan, was wrecked on the coast, and brought the first accounts of the country to Europe. About the year 1620, a Japanese squadron left a party on the island, in the view of returning to effect its subjugation; but, in the mean time, a Dutch ship having touched there in its course from Japan, it appeared to be so eligible a station for a commercial establishment, that they built fort Zealand in 1634, and thus secured possession of the principal harbour. In 1661 they were driven from the settlement by the celebrated Chinese pirate, Tchin-tchi-kong, or Coxinga, (See CHINA, Vol. VI. p. 233,) who made himself master of the western part, and held the sovereignty of the island during his life; but, in 1682, his grandson Tchin-ke-sun, submitted to the authority of the Emperor Kang-hee; and the island, since that period, has been tributary to China. By a chain of mountains running from north to south, it is divided into two parts, called the western and eastern provinces, the latter of which is still occupied entirely by the native Indians, and the former contains the settlements of the Chinese. It is subject to the Viceroy of Fokien, but a governor with a large detachment, generally of 10,000 men, resides constantly on the island. Tai-ouan, the capital city and the seat of government, is situated on the south-west coast in 23° North Lat. and 3° 32′ 50″ East Long. from Pekin. It is a large and populous place, full of trade, and equal to several cities of the first class in China. The streets are remarkably straight, about 40 feet broad, and some of them a full league in length; but they are badly paved, and the houses meanly built of clay and bamboo, and thatched with straw. On account of the excessive heat of the sun, the streets are covered, during seven or eight months of the year, with awnings, which leave nothing to be seen but the shops on either side, in which various kinds of merchandise, ranged with the greatest order and show, present a rich appearance to the eyes of the passenger. The town has no walls or any kind of defence, unless a large edifice, built by the Dutch, and protected by four demi-bastions, may be considered as a fort. The harbour is good, but its entrance is becoming daily more difficult. The city is said to contain every necessary of life and article of traffic; both foreign commodities, such as Chinese and Indian cloths, silk stuffs, porcelain, and European goods; and also the productions of the island, cotton, hemp, rice, sugar, salt, tobacco, dried stags flesh, fruits of all kinds, and abundance of medicinal herbs.

The western province contains, besides the capital, a number of smaller towns and populous villages, in which the Chinese permit none of the native inhabitants to reside along with them, except those who act in the capacity of slaves or domestics. It appears that the Chinese population of the island would increase with great rapidity, if the government would permit free emigration from other parts of the empire; but permission to new settlers is granted with great caution, and only upon the payment of a considerable sum for the proper passports. The reason is, that the Tartar emperors are always apprehensive of a revolt among their Chinese subjects; and the proximity of this island to China, would render it a favourable field for the operations of malcontents. The district, which the Chinese possess, consists of extensive and fertile plains, watered by numerous rivulets, which flow from the mountains towards the east. The climate is temperate, except when the sun is vertical, and the air is serene and pure, cooled even in the hot season with constant breezes. The soil is in general mountainous, but naturally productive. Besides most kinds of grain, which it yields in abundance, there are found in the country the principal Indian fruits, such as oranges, bananas, cocoa-nuts, guavas, papaws, pine apples; and many of those which are common in Europe, particularly peaches, apricots, figs, grapes, pomegranates, water melons; cinnamon, sugar, pepper, camphire, tobacco, are also among the ordinary productions of the country; and the mountains contain mines of gold, silver, copper, and sulphur. There is no good water to be found in the whole island; and strangers are said to suffer greatly from its bad qualities. There are few horses, sheep, goats, or hogs, on the island; but the inhabitants breed a great number of oxen, which they train for the purpose of riding; and, being early accustomed to this kind of service, they are said to go very securely and expeditiously. Domestic fowls are reared in great plenty. The finest deer wander in large herds through the country. Tygers, leopards, monkeys, and every kind of game, abound in the forests; and the rivers furnish abundance of fish.

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[*] See FORFARSHIRE, p. 476.

[†] *Tai-ouan*, signifies the chief of ten thousand, in allusion probably to the number of small islands in its vicinity; and Formosa was a name given by the Portuguese, on account of the beautiful appearance of the country.

The Indians inhabiting the western division are entirely subject to the Chinese governor, and pay a regular tribute in grain. They compose about forty-five villages, most of which are found in the more northern quarter of the province. In each village is stationed a Chinese officer, whose duty it is to learn their language, and to superintend the collection of the impost; but these agents of the government often act in such a tyrannical manner, as to occasion the defection of the inhabitants, who have sometimes been driven to unite themselves with the independent tribes in the eastern part of the island. Even those which are most submissive to their invaders, still retain some of their ancient institutions; and in every village three or four of the most upright and intelligent old men are chosen as judges and rulers, who have the power of determining all disputes, and disobedience to whose decisions would be punished by perpetual banishment from the community. In these villages subject to China, and which are the most populous, there is a great degree of civilization; and the houses are built and furnished after the manner of the Chinese. They are clothed with the skins of the stags, which they kill in hunting; and wear on their heads caps of a cylindrical shape, made of palm leaves, ornamented with a succession of crowns one above the other, and surmounted with plumes of feathers from the cock or pheasant. The dress of the women exactly resembles that of the men, except that their clothes are longer, and their heads more furnished with finery. But the southern or eastern islanders are still in a most savage state; and their habitations are mere earthen huts, without any piece of furniture, having only a kind of hearth in the centre upon which they dress their victuals. They are remarkably dirty in their manner of eating; and generally devour the flesh before it is half dressed. Whatever they prepare is placed on a plain board or mat; and having neither plates nor spoons, they make use of their fingers for conveying it to their mouths. They have no better bedding during night than fresh gathered leaves; and no other covering through the day than a piece of cloth, which hangs from their middle to their knees. They subsist chiefly upon rice and the produce of the chace. Their favourite weapons are lances, which they throw with the greatest dexterity and precision to the distance of 60 or 80 feet. They use also bows and arrows, with which they can kill a pheasant on the wing with as much certainty as a European sportsman could with a fowling-piece. They run with such surprising swiftness, that they can almost outstrip the fleetest greyhound, a degree of agility which the Chinese ascribe to a custom which they have of confining their knees and reins with a close bandage, till the age of 14, but which is, more probably, owing entirely to their constant practice in hunting, and to the estimation in which the qualification is held. Those who are most swift and skilful in the chace, are distinguished by the honourable privilege of having figures of flowers, trees, or animals punctured on their skin; and the more ordinary decorations consist in wearing bracelets, or crowns made of shells and crystal, and in staining the teeth with a deep black colour. The matrimonial connections of these islanders are remarkably simple and unconstrained, especially when compared with those of their Chinese neighbours, and are left entirely to the choice and arrangements of the young people. When a youth has fixed his affections, he appears for several days with a musical instrument in his hand, hovering around the place where the young woman resides. If she is pleased with his personal qualifications, she comes forth and joins him, when they settle together their future union. They then give notice of their intention to their parents, who prepare the marriage feast, which is always held in the bride's habitation, with whom the husband remains during life. He transfers his filial duties to his father-in-law, and devotes himself to the support of the new family, of which he has become a member. Hence the natives of Formosa offer vows chiefly for female children, who procure their sons-in-law to be the support of their old age. These people are represented as destitute of religious notions and worship, and as guided by the pretended predictions of a set of priestesses or female jugglers; but other accounts seem to imply, that they are not without some ideas of the soul's immortality, nor so deficient in civilization and ingenuity; and many of them are said to retain a considerable portion of Christian knowledge, which had been communicated by the Dutch settlers. There is, in fact, very little known respecting the eastern, or, as it is sometimes called, the southern part of the island and its inhabitants; and the accounts both of the Chinese and Dutch writers are filled with stories so obviously fabulous, as to discredit their whole testimony. Some of these accounts bear, for instance, that one of the natives was seen who had a tail above a foot in length, covered with red hair, and resembling that of an ox, and who declared that all the inhabitants of the southern districts were born with similar appendages; that the men do not marry till they are fifty years of age, and that their wives are not suffered to bring forth children till they have passed their thirty-seventh year, and should any of them prove pregnant before that period, the priestess is summoned to produce abortion by treading on their womb. One of the most extraordinary of these histories, and which was afterwards acknowledged by its author to be a mere romance, was published about the year 1710 by the noted Psalmanazar.

In consequence, it is supposed, of the sulphur mines in the mountains, which run across the middle of this island, it is subject to frequent earthquakes; and, in the year 1782, one of these shocks was attended with so tremendous a hurricane and swell of the sea, as to threaten the total destruction of the Chinese settlements. See Grozier's *Description of China*, vol. i.; *Collection of the Voyages of the Dutch East India Company*, vol. v.; Du Halde's *History of China*, vol. ii.; and *Univ. Mod Hist.* vol. viii. and x. (*q*)

FORRES, a town of Scotland, in the province of Moray, is situated on a rising ground, about a mile to the east of the river Findhorn, and two miles from its mouth. The houses are well built, but the town contains no public buildings of importance. On the summit of Cluny-hill, a quarter of a mile to the east of the town, a monument has been recently erected to the memory of Lord Nelson. It is a lofty octagonal tower, about 70 feet high, and having a base 24 feet in diameter. It is surmounted by a battlement and a flagstaff. The castle of Forres was situated at the west end of the town. About a quarter of a mile to the north-east of Cluny-hill, on the road to Findhorn, stands the celebrated obelisk called Sweno's Stone, which is composed wholly of sand stone, though it is said that there is no quarry of the same stone nearer than fifteen miles. It is about 23 feet high, 3 feet 10 inches broad, and 1 foot 3 inches thick, and is said to be 12 or 15 feet below the ground. "On its east side," says the author of the Antiquities of the Province of Moray, "are several divisions, each occupied by variously sculptured ornaments. At the top are a number of beautiful Gothic ornaments; and in the first division underneath, are nine horses, with riders, marching in order. In the next, is a line of warriors brandishing their weapons. The figures of the third are now much defaced. In the fourth, several men, armed with spears, seem to guard a number of human heads under a canopy; the bodies appearing to be piled upon the left of the division. A body of horse appears in the fifth division, and these are followed by men on foot; the first line having bows and arrows, the other three swords and targets. In the lowest division now visible, the appearance is of horses seized, their riders beheaded, and their heads thrown under an arched cover. The west side of the obelisk is chiefly occupied by a magnificent cross, and covered over with an uniform figure, elaborately raised, and interwoven with great art and accuracy, having the appearance of Runic knots. Under the cross are two figures, supposed to represent personages of distinction, in an attitude of friendly salutation. On the north edge, are some curious carvings, below which are rows of human figures, hand in hand, in apparent amity and confidence."

In order to prevent this monument from falling down, several freestone steps were lately built round its base. The Rev. Mr Cordiner, who has published an engraving of this monument, supposes it to have been erected in commemoration of the peace concluded between Malcolm, king of Scotland, and Canute, the Danish king of England, in 1002. Others have imagined, that it was erected in memory of the assassination of King Duff; and this opinion is conceived to be strengthened by the discovery of eight human skeletons laid along a trench, in a little green mount close by the obelisk, supposed to be the assassins of the king. On the declivity of Cluny's Hill, looking towards Sweno's stone, there are obvious remains of extensive entrenchments.

The corporation of Forres is governed by a provost, two bailies, and a dean of guild, who are elected annually; and it enjoys the privilege, conjointly with Inverness, Nairn, and Fortrose, of sending a member to Parliament.—Within these few years, a subscription library has been instituted by the inhabitants, and now contains a considerable number of volumes.—The scenery on the river Findhorn, extending from the vicinity of Forres for nearly 20 miles upwards, is remarkable for its grandeur and beauty. The banks are for the most part rocky, and richly wooded, with every variety of form, and height, and inclination. For two or three miles below, the rock is sandstone on each side, and to this succeeds above gneiss and granite. The forest of Darnaway forms the chief part of this scenery on the left bank of the river; and opposite to it, on the right, are the properties of Relugas, and Logie, and Altyre. The first of these is matchless for its natural beauties, and has been adorned with singular taste.

Three miles north of Forres, close to the shore of the Moray Frith, there is one of the best examples of an inundation of sand which is to be seen in the island. The sand drifted from the shores of the Frith above, by the strong west winds, is accumulated in hills of considerable size, forming a chain about a mile, or a mile and a half in length, and at some parts nearly a quarter of a mile broad. The hills are often undergoing changes of form and height, but have not for many years exhibited any tendency to general diminution. About 60 or 70 years ago their increase was very great, and very sudden, the inundation burying completely, in the course of a few days, the estate of Cubin.

Five miles east of Forres, is the heath which Shakespeare is supposed to have intended as the scene of the first interview between Macbeth and the weird sisters.

There are few places in Scotland better adapted for a cheap and pleasant residence than this small town. Its climate is excellent; its markets are good; it is abundantly supplied with a variety of fish, from the neighbouring seaport of Findhorn, which is only five miles distant, and the surrounding country is rich and luxurious, and abounds in game.

The following is the population of the burgh and parish in 1811:

Number of inhabited houses	672
Families	801
Ditto employed in agriculture	108
Ditto employed in trades, &c.	295
Males	1225
Females	1700
Total population	2925

See *Account of the Antiquities, &c. of the Province of Moray*, p. 33. (*j*)

FORT. See FORTIFICATION, and FORTS, *Vitrified*.

FORT-AUGUSTUS. See INVERNESS-SHIRE.

FORT-WILLIAM. See INVERNESS-SHIRE.

FORT-GEORGE. See INVERNESS-SHIRE.

FORTAVENTURA, or FUERTE-VENTURA, is the name of one of the Canary Islands. It is about fifty miles long, and from eight to twenty-four broad. The island is very low, and narrow in the middle, and is almost cut in two by the sea. The portion south of the isthmus is mountainous, sandy, and barren. The portion to the north of the isthmus is also mountainous, but contains several fertile and populous districts. The villages are here so numerous, that the traveller no sooner loses sight of one than he discovers another.

The principal towns in the island are, La Villa, the capital, which is situated to the north of the isthmus, and contains 100 houses; Oliva, situated in the middle of a fertile plain, and containing fifty houses; and Tunche, which contains about 100 houses. On the east coast there are three small sea ports, called Langla, Torrafats, and Pozzo Negro. A great quantity of goat milk cheese is made in the island, which breeds 50,000 kids, each of which weighs between forty and fifty pounds.

For an account of the history, agriculture, commerce, and productions, of the Canary Islands, see CANARY ISLANDS. The position of the western point of Fortaventura, according to solar observations, is West Long. 14° 31′ 15″, and North Lat. 28° 4′. (*j*)

FORTH, (including the arm of the sea generally called the *Frith of Forth,*) is the name of the largest river of Scotland, and that which has the longest course, rising on the north side of the mountain Ben Lomond, and discharging itself into the German Ocean in 55° 54′ of North Latitude. The Forth, near its source, receives a small stream, and is then called Avondow, or the Black River; and, on entering the parish of Port, receives the name of Forth, which is said to signify the same. Soon afterwards it expands into a beautiful lake, from whence it is precipitated over a perpendicular rock, 30 feet high, and flows with a smooth winding course from Gartmore to Stirling bridge, 33 miles, though only 20 in a direct line. Thence, having received a considerable accession in the waters of the rivers Teith, Allan, and Dovan, it gradually enlarges to 4 miles in width at Borrowstounness, but exhibits the most singular and beautiful sinuosities in traversing a level plain, called the Carse of Stirling, where 24 miles occupied by its channel are no more than 6 miles in a straight line by land. It is next narrowed to less than two miles by the sudden projection of headlands from the two Queensferries on its opposite sides, below which a regular expansion, little interrupted, (the *Bodotria* of the Romans, and now named *Frith of Forth,*) is resumed down to Fifeness on the north, and St Abbs Head on the south, where it meets the German Ocean. Between these two points the distance is between 35 and 40 miles. The direct course of this river is scarcely less than 100 miles; but its sinuosities do not traverse a shorter space than 200. Its depth from Stirling bridge to the mouth is from 3 to 37 fathoms, or more; between Inch Garvie and the North Ferry it is 35; and somewhat further west, opposite to Rosyth castle, where the breadth is 3000 yards, it is 21 fathoms, whence it gradually shallows upwards. Part of the bottom is here covered with sleech or mud 20 feet deep, deposited on freestone. The tide flows a mile above Stirling bridge, or between 70 and 80 from the sea in a straight line, until it is interrupted by a rock across the channel, where stream tides rise five feet. It flows and ebbs regularly twice in twenty-four hours; but the flood and ebb run about two hours longer in the middle than along the shore, and it rises at most about four fathoms in a stream. Besides this, however, there are particular currents, or irregularities, above Queensferry, and particularly from Culross to Alloa, or, beginning at the mouth of the river Carron and Borrowstounness, continue downwards. These irregularities consist in an intermission of the tide during the flood; and before high water the sea ebbs. On the contrary, while the sea ebbs, and before low water, the ebb intermits, and a flow commencing continues some time; after which the ebbing is resumed until low water. This is seen during two hours, and the irregularity occupies more of the river according as it is spring or neap tide. These irregularities are well known by the name of *leakies.*

Tributary rivers.

The principal rivers tributary to the Forth are, the Goodie, rising in the Loch of Monteith, the Teith, and Allan, above Stirling bridge; and below it, the Dovan, Carron, Avon, Almond, Leith, Esk, Leven, Tyne, and others. There is, besides, a communication, by means of a navigable canal, with the river Clyde, which preserves an intercourse between the east and west coasts of Scotland.

It would take a long time to describe the natural productions of the Forth, and hitherto they have met with very little attention. Various cetacea, from 20 to 60 feet in length, migrate here from the northern seas; and whole shoals of grampuses have accidentally stranded themselves on the shores. We learn from history, that five or six hundred years ago they also frequented this river. The porpoise is constantly seen tumbling in the water; one specimen of the beluga, or white whale, was killed in 1815, near Stirling: the sun fish is occasionally taken; and the opah, or gold fish, has also occurred. But there are others, the constant source of valuable and productive fisheries; such as salmon, herring, haddock, turbot, and oysters. A great salmon fishery is carried on at Stirling, which supplies all the neighbourhood, and allows a quantity for export. Salmon is so abundant, and so easily obtained at this part of the Forth, that the inhabitants of Stirling were, during a long time, provided with it at the rate of three halfpence a pound, which became a particular privilege, nor is it long since it was abrogated. Two fisheries on a smaller scale have recently been established on the south side of the river, at Abercorn, and near Queensferry, and their produce chiefly transmitted to the capital; and a third was attempted near the first, which had some success, at Blackness castle. Vast shoals of herring resort periodically to the Forth, and afford employment to many hands in their capture, as well as ample subsistence to the poor; but they are neither so large nor so much esteemed as those taken on the west coasts of Scotland. Nevertheless, their cheapness, which is sometimes sixpence a hundred, is of incalculable benefit to a large city, where there are many indigent inhabitants, as well as to the towns on the coast, which in general possess little wealth. The herring fishery, which has rather declined of late from the uncertainty of success, is carried on from the mouth of the river to six or eight miles above Queensferry. Haddock, cod, and turbot fisheries, are principally lower down than Leith. Skate, flounders, and halibut, are common; turbot is obtained in sufficient quantity to supply Edinburgh market at prices not immoderate, that is, from four to ten shillings, according to size and scarcity; but most of it goes to London. Some time ago, contracts were made for turbot, at two shillings each when taken, to be carried thither. Soles also inhabit the sandy bays of Aberlady and Musselburgh, but are seldom caught. This being ascribed to the unskilfulness of the fishermen, an experiment was made by others purposely brought from places noted for it; but, after repeated trials, the fishery was given up. To judge by the shells thrown up on the coast, an extensive portion of the Frith is inhabited by oysters; and accordingly, many valuable oyster beds are resorted to, for the most part to the eastward of Leith. There is little doubt, however, that there are others for several miles westward of it. Great quantities of oysters are consumed; for it is a favourite kind of food both in the sea-port towns and in the country; and there are particular rules observed in dredging, and in rejecting those of insufficient size. The beds themselves belong to different private proprietors; but some have been totally exhausted from injudicious management. The consumption of oysters is so great in the metropolis, that there are certain regulations established for conducting the market. Mussels are also collected in quantities along the shores; and while oysters are sold by numbers, they are sold by measure at so much per pint

Natural productions.

Many of the mollusca tribes, besides the two latter which we have alluded to, inhabit the Frith; and probably the majority are yet non-descript. Medusæ, actiniæ, nereids, are seen in great variety and beauty;

Natural productions.

and conchology has still to receive accessions in the history of the shells which may be recovered here. Little need be said of the ornithology; for, except in the wild fowl resorting hither during winter, and in the numbers of solan geese frequenting a small rocky island called the Bass, there are no peculiarities. Few phocæ are seen but on some of the rocks, and occasionally near the shore.

Minerals.

The minerals are more important. At first, the course of the Forth is through deep clay, and near impassable mosses. Expanding towards the east, it approaches vast strata of coal, beds of lime and ironstone, found alike on each side of the river; and some of these are not only on the banks, but penetrate far under its bottom—so far, that it is reported the workmen from the opposite coasts can hear each other's operations below, where it is more than three miles wide. Neither is this so improbable as might at first sight appear; for the coal workings from the north at Culross are said to have been carried two miles under the Forth; and from Borrowstounness on the south, they penetrate 1700 yards. The principal mines are in the neighbourhood of Alloa, which exports 35,000 tons annually; Culross, Borrowstounness, Torryburn, Inverkeithing, Dysart. Some of these mines have been open above five hundred years, and have been carried to great extent. John Taylor, the Water Poet, who published an account of his travels in 1618, expresses great admiration of the entrance to one of the Culross mines by a pit far within high water mark. The mouth of the pit was defended by a strong circular bulwark, which likewise served as a pier for vessels to load immediately from the mine itself, without land carriage. But, during some very tempestuous season, the bulwark either yielded to the violence of the waves, or the rising tide overflowed it, so as to render the mine useless ever since. It is said, that King James VI. having, by more than an ordinary effort of courage, penetrated this mine from the land side, where there was also access, and being conducted to the mouth of the pit, where he suddenly beheld himself surrounded by the sea, loudly exclaimed, *treason! treason!* but an attendant, pointing to an elegant bark anchored here, endeavoured to dispel his fears; and the king preferred being carried in it directly ashore, to descending within and returning below ground. At the end of a reef stretching a mile from the shore of Torryburn, an engine has been erected, which, as its walls are environed by the rising tide, appears an isolated tower in the middle of the river. In addition to the home consumption, great quantities of coal are exported from both sides of the Forth, both coastwise and to distant countries. Lime is wrought to a great extent on many parts of the banks of the river, from the parish of Aberfoyle, near its source, downwards; but the principal quarry is at Charlestown in Fife, 12 miles north-west of Edinburgh. Several hundred persons are continually employed there; and the lime is exported in numerous small vessels from a harbour beside the kilns to different parts of Scotland. Being of the best quality, it is applied equally to building and the manuring of ground. In some places, the limestone rock abounds with entrochi, and, being sufficiently hard to enable it to receive a polish, is used for ornamental purposes, under the name of *Fife marble*. There is abundance of ironstone, either scattered about the shore in loose nodules, or dug from pits. It has partly been sent to Carron, and partly to the English founderies; but the expence of obtaining or collecting the loose nodules or septaria, has hitherto greatly diminished the profit that would otherwise result from this very rich sort of ironstone. Pieces of fine jasper, pebbles, granite, and petrifactions, occur on many parts of the shore.

Islands.

There are several rocks and islands scattered throughout the lower part of this river, where it has expanded into a frith, of which Inch Garvey, Inch Colme, Inch Keith, the Bass, and the Isle of May, are the principal. On the top of the first, which is barren and rocky, stands a small fort, with two inconsiderable pieces of cannon, and one invalid soldier, who is stationed there in solitude six weeks at a time. It was sometimes converted to a state prison of old, but now belongs to a private family. This island, standing in the middle of a strait, between the Queen's Ferries, could effectually prevent any hostile approaches higher up the river. Inch Colme, which scarce exceeds half a mile in length, and is narrow, enjoys greater celebrity; for one of the kings of Scotland, having escaped imminent danger, while he found an asylum on it, shewed his gratitude to Divine Providence, by erecting a monastery here in the year 1123. Its picturesque ruins are still extant. Soon after the commencement of the late war, in 1793, a battery of heavy guns was constructed on Inch Colme, which, it was supposed, would command the deep water of the Forth, but no opportunity has been afforded of trying their effect, which those who consider themselves well acquainted with the navigation of the channel have doubted. The island abounds in rabbits, and belongs to the family of Murray. Cramond Island, nearly opposite, on the south side, is connected with the land at low water, but the access, unless in a certain direction, is very dangerous, from deep mud or quicksands. The island best known, at least to the inhabitants of the capital, is Inch Keith, which lies about half way between the coasts, and somewhat eastward of Edinburgh. It is between two and three miles in circuit, of fertile surface, and has always been pastured. Circumstances have frequently renderdered this inconsiderable spot of importance, from an early date, either in civil or military operations. In the year 1497, when the venereal disease was making uncommon ravages in Edinburgh, and was then, as in the rest of Europe, considered a pestilence, the magistrates directed that all persons infected with the "grand gore" should repair to the sands of Leith, where they should find boats ready to convey them to the island, "there to remain, untill God should provide for their health." In the reign of Edward VI. the English sent two expeditions equally destructive into Scotland, when Inch Keith was taken and fortified. They were expelled by the French, who erected fortifications on a larger scale, consisting of a strong tower on the highest ground, with an interior court, 100 feet in diameter, as also an external wall of hewn stone, 20 feet high, and 9 feet thick, with Queen Mary's arms sculptured on it, and a motto *sa vertue m'attire*; but the whole fort was afterwards demolished by order of the Scotish parliament. More recently, when a Russian fleet lay in Leith roads, during the last war, there was an hospital here for their seamen; and at present it has a lighthouse for the safety of mariners. The Bass is a lofty precipitous rock, with a conical summit rising from deep water, within two miles of the southern shore of the Forth, near North Berwick. This isle, which is less than a mile in circuit, is accessible only by a dangerous and narrow pathway: formerly it was employed as a state prison, and a small fortress upon it surrendered to Oliver Cromwell. It was held in property by a private family, and purchased by government in the reign of Charles II.; but after most of the kingdom had submitted to the sovereignty of William, at the revolution, the fortress was held out by a few of the abdicated monarch's adherents, which produced an order for its demolition on their surrender. The Bass is now in the hands of a subject, by whom it is leased, for a rent which is indemnified by the innumerable flocks of solan geese taken annually on it, (see Bass). The Isle of May lies nearest the mouth of the Forth, and is probably the largest of the whole, being nearly three miles in circuit, and is situated six or seven miles south-east of the town of Anstruther. It affords good pasture, and has a pool or small lake of fresh water. Anciently this island belonged to an English monastery, for the monks of which, King David I. of Scotland founded a call or priory of the order of St Augustine, and there was also a chapel dedicated to St Adrian. The latter was frequently resorted to in pilgrimages, and particularly on account of barrenness, though not for that reason only, as Andrew Wood of Largo, a celebrated Scotish mariner, held certain lands in Fife for the service of piloting James IV. and his queen to St Adrian's chapel. A lighthouse was erected here in the reign of Charles I., which has undergone many successive improvements, and receives a duty from all vessels navigating the river. Both it and the island being private property, frequently changed their owners, and having lately passed by marriage into the Duke of Portland's family, they were purchased by the Commissioners for Northern Lights in 1814, for L. 60,000 sterling, when affording a very considerable revenue.

Trade and navigation.

There are numerous towns and harbours along both sides of the river and Frith of Forth, where trade and manufactures are carried on in various branches. Commencing with Stirling, where it is crossed by a bridge of four arches, the principal towns are Grangemouth, Borrowstounness, Queen's Ferry, Leith, Musselburgh, Prestonpans, and Dunbar on the south side; and on the north, are Alloa, Culross, Charlestown, Inverkeithing, Burntisland, Kircaldy, Dysart, Leven, Pittenweem, Anstruther, Crail, with a few of lesser note. The number of piers and harbours is not less than thirty; and some of them of expensive construction, such as Leith, where there are considerable wet docks; there is a fine basin at Borrowstounness; and at Queensferry the most recent improvements have been adopted. But storms from the east, attended with a tempestuous sea, occasionally damage the harbours. Excepting Stirling and Leith, few of the towns contain 2000 inhabitants, and several of them not half that number. The principal manufactures are of iron, salt, pottery, sal ammoniac, some bricks and tiles, and recently Roman cement and alum have been fabricated at the village of Blackness. There is also linen made on the north side, along the coast of Fife, and soap on the south side, together with oil. Coal, lime, and grain are the chief exports of natural products: but foreign products are brought from the west by the great canal, and carried eastward; and there is a vast quantity of artillery and iron manufactures exported from the Carron founderies. The vessels belonging to the different ports are mostly occupied in the coasting trade, but whole fleets resort to the Baltic; several vessels belong to the Greenland whale fishery, and a few are engaged in West India traffic. Independent of the manufactures carried on in the vicinity of the river, cotton, linen, and muslin goods are exported, and some groceries, wood, flax, and other commodities imported; to receive the duties on all of which there are custom-houses along both sides of the river. The chief trade, however, is conducted on the same side with the metropolis.

When the Romans invaded Britain, they found the northern parts occupied by various barbarous tribes; and to repress the incursions of those to the west, erected a strong rampart, now called Adrian's Wall, from the Frith of Clyde to the very banks of the Forth, where it terminated in the vicinity of Blackness Castle. Here, a Roman fort is supposed to have stood; but in the reign of the Roberts, we learn from ancient record, that the site of the present edifice was a receptacle of lawless banditti, and it was probably founded about that period. It is washed by the sea on three sides, contains a deep well of fresh water, and, like the two fortresses already mentioned, was frequently converted to a state prison. Now, there are five unserviceable cannon on the walls, of small size; and it is a place of no strength, being commanded by several eminences. Nevertheless it has repeatedly been the subject of anxious competition in the factious times of old, and is preserved as a fortification by the articles of the Union. A more modern fort was erected between Leith and Newhaven, on the appearance of Paul Jones, a noted pirate, upon the coasts of Scotland; and still more lately, a small battery at the North Ferry. These, together with the batteries before mentioned, and a martello tower, almost finished, at the mouth of Leith harbour, constitute the principal defence of the Frith.

Besides the navigation of the Forth, for the purposes of trade, there are several regular ferries between the opposite coasts, from Stirling to Leith; and packets sail from the latter harbour to different towns, as Anstruther and Ely on the coast of Fife. Three steam boats also began to navigate from Leith upwards, in the year 1814, affording a cheap and commodious means of conveyance. But it has been proposed, at various times, to facilitate the communication with the west still farther, by rendering the river navigable from Stirling bridge to Gartmore, and to intersect the different curvatures of the land to the east of Stirling by a canal. According to an estimate, when this subject was particularly urged in the year 1774, by expending £13,236, such improvements could have been made, as to admit the navigation twenty miles in a direct line above Stirling bridge, by boats fifty or sixty feet long, thirteen wide, and drawing three feet and a half of water: And the navigation could be carried downwards to Alloa, six miles in a straight line, instead of the present windings of the river, through twenty-four. Advantage would doubtless have resulted by putting the proposal into execution, but it was in a great degree superseded by the canal between the Forth and Clyde. Another project, much more singular, was made in the year 1806, to connect the opposite sides of the river by a tunnel passing under its bed. The passage between the ferries being frequently interrupted by storms, and much difficulty being experienced in the transportation of great numbers of cattle continually brought from the north of Scotland, it was thought that such an expedient would remedy these inconveniences, and it was patronised by many intelligent persons. A spot, about half a mile west of Blackness Castle, where the tideway is 3839 yards in breadth, was considered the most favourable point for the south entrance; and the depth of water not exceeding thirteen fathoms and a half, rendered it preferable to the strait between the Ferries. A long time was employed by engineers in sounding and boring; but it appeared, on penetrating the bed of the river, that a sufficient roof could hardly be obtained for the tunnel, which, conjoined with other weighty objections, led to the dereliction of the project. See Sir Robert Sibbald's *Works*. *Statistical Account*, vol. vi. p 21. Millar and Vazie *on Tunnels*. Knox's *View of the British Empire*. (c)

FORTIFICATION.

Definition.

FORTIFICATION is the science that teaches the best method of putting a town, citadel, or other military position, in such a state of defence, as may enable a small number within to hold out against the attack of a great number from without, and to afford the besieged the best means of annoying and cutting off the assailants, with the least possible danger to themselves.

Origin and progress of fortification.

The origin of fortification may be traced to the inequality that has always subsisted among different states, with regard to military power. When a nation found itself attacked by an ambitious and restless neighbour, that could bring into the field either a greater force, or an equal force with greater rapidity, it would have recourse to a defensive system of warfare, taking advantage of the mountains, rivers, woods, ravines, and other natural means of protection, which the country afforded. In this way, a very superior invading force might be defeated, or at least kept in check a sufficient length of time, to allow the invaded state either to march its own armies to the point of attack, or to procure the assistance of other states, whose interest it might be to support a weak neighbour against the attacks of a stronger. Were the political divisions of the earth so arranged, that the weaker states should always have the advantages of mountains, rocks, marshes, &c. on their frontiers, their deficiency in military force would be in some measure compensated by *natural fortifications*. But as considerations of a very different kind have generally regulated the partition of territory, small states have not unfrequently been destitute of all such advantages. Unless, therefore, such states could supply, by artificial means, those bulwarks that had been denied them by nature, they must have been constantly at the mercy of the first stronger power that chose to attack them. We find, accordingly, that various kinds of artificial fortifications have been employed for purposes of defence; and that the construction of these has always been considered as an object of the highest importance. It is the only means of placing a weak state on a footing with its neighbours, whether its weakness arises from a deficiency in physical strength, or from the operation of moral causes.

The most obvious method of protecting an open country from sudden invasion, would be to carry a wall round the whole frontier. Of this species of fortification, is the great wall that separates China from Tartary, and likewise the Roman wall in the north of England, built for the purpose of defending the southern part of the island from the sudden incursions of the Picts. But besides the insuperable objection, that, in many cases, it was utterly impossible to command the means of raising such walls, it was soon found that the difficulty of guarding such an extensive line rendered them of comparatively little use. Such methods of defence were therefore soon abandoned, or rather were seldom adopted, and, in their stead, detached fortifications were constructed at particular points, and at a moderate distance from one another. These forming a communication between the different commanding positions on the frontier, were found to possess all the advantages of one continued fortification, while they were constructed at much less expence, and defended with infinitely greater ease. An invading army could not venture to leave these places of strength in their rear, without the greatest danger of having their retreat cut off; and consequently a country, possessing such fortifications, could seldom be subject to sudden attacks. Nor is this the only advantage that is found to result from such fortified places. By making them depots for arms, ammunition, and other military stores, they become the surest protection of established governments against rebellion or any internal commotion. To the art of fortification, then, may perhaps be justly ascribed not a little of that peace and good order among mankind, which would otherwise be sacrificed to the lawless ambition of despots, or the madness of factious demagogues.

Ancient system of fortification.

It is impossible to say at what time, or in what country, men first began to construct fortifications. In a rude state of society, when weapons of attack were few and simple, and when the success of war depended more on the physical powers, than the skill of the combatants, little ingenuity would be necessary to render a place impregnable, whatever might be the force of the assailants. An earthen mound, a deep ditch, or a single stone wall, would probably be sufficient not only for protecting a garrison against sudden attacks, but even for enabling it to hold out against a regular siege. How long the art of fortification continued in this simple state, we have no means of ascertaining; but it is evident, from various passages of sacred history, that it had made considerable progress in Eastern countries in the days of Moses, upwards of 1500 years before Christ. From these countries, it probably travelled to the West, where it received great improvements from the Greeks and Romans. By inventing new methods of attack, these warlike states obliged the besieged to adopt new methods of defence; and thus while they exercised their own ingenuity in the art of war, they called forth that of the nations with whom they contended. A single mound, or stone wall, was soon found to be altogether inadequate to resist the force of the engines with which they were assailed. The wall or rampart was accordingly strengthened by towers erected upon it at convenient distances, and from these the besieged were enabled to defend the intermediate parts of the wall, which they could not otherwise have done without exposing themselves to the missile weapons of the enemy. Besides these towers, the rampart itself sometimes consisted of a double or even a triple wall. Of this kind were the walls of Jerusalem and Babylon.

Ancient system of attack.

The most obvious method of assaulting a fortified place in rude ages, would be to construct an earthen mound or counter fortification, from which the assailants could engage with the besieged on equal terms. This method of attack was probably coeval with the art of fortification itself, as from the passages of sacred history to which we have already alluded, it appears to have been common in Eastern countries at the time of the Israelites taking possession of the land of Canaan. The same method of besieging towns was adopted by the Greeks and Romans. They constructed their circumvallation of turf, and, in some cases, they were made double at an interval of fifteen or sixteen feet. The interior wall was intended to preserve them from the sallies of the besieged, the exterior to guard them against the attacks of those who might come to the assistance of the town. The space between the walls or mounds was occupied with tents and lodges for the soldiers. These walls were surmounted with turrets, after every tenth of which was a tower, extending from wall to wall, and equal in height to the fortifications of the town. After all, this method of attacking a place was better calculated to starve it into a surrender, than to take it by force.

Aggera of the ancients.

Another, and perhaps a more expeditious method of attack, was by means of detached mounds or *aggera*, erected opposite the weakest part of the fortification. These aggera were constructed of all sorts of materials, as wood, stone, earth, &c. and gradually carried forward till almost close to the walls. The besiegers were thus raised to a level with their enemies, and sometimes succeeded in throwing bridges between the aggera and the fortification, by which they stormed the place. Still, however, this method of attack was liable to a serious objection. The laborious nature of the operations necessary in constructing even single and detached mounds or aggera, afforded the besieged time enough to strengthen such parts of their rampart as were threatened, and thus deprived the assailants of no inconsiderable part of the advantage to be derived from their works. The invention of moveable towers or turrets was therefore a very great improvement in the art of attacking. These towers were erected on wheels and rollers, by which they could easily be moved from one place to another; and, in point of size, were proportioned to the height and strength of the place to be attacked. In their most improved form, they consisted of wood, and were so constructed as to be taken down and carried about with the army as part of the baggage.

Testudo.

But the great difficulty of attacking fortified places in ancient times, did not consist in the prodigious labour, so much as in the danger to which the besiegers were exposed in constructing their outworks. From their situation, the besieged were enabled powerfully to annoy their enemies, with comparatively little danger to themselves. Huge stones, and other heavy bodies, thrown from the ramparts, became formidable and destructive weapons, against which the besiegers could find no protection in the ordinary means of defence. It was to prevent the fatal effects of such weapons, that the *testudo* was invented. This consisted of a number of soldiers, arranged in different forms according to circumstances, but all holding their shields above their heads, thus forming a canopy or covering over those who were employed in the works beneath. The testudo was also sometimes employed, for the purpose of taking a place by storm, when the garrison was not in a proper condition to defend itself. In this case, the front rank stood upright, holding their shields before them; the second held their shields above the heads of the first, at the same time stooping a little; the third stooped still more, holding their shields also above their hands; and so on to the rear rank, which was in a kneeling posture, thus exhibiting the appearance of a tiled roof. On this roof, another body of men was drawn up in the same form, and protecting themselves in a similar manner. A number of successive stories being thus constructed, those that formed the highest were enabled to engage on equal terms with the besieged, and frequently succeeded in getting possession of the place.

Approaches.

In later times works were constructed, and attacks made on fortresses under the protection of covered ways, or approaches. These approaches were generally the work of great expense and labour, being guarded on one side, and sometimes also on the other, with a mound of earth, and covered on the top with skins of animals, rafters, or bundles of rods, called *fascines*. At the extremity of the approach, was erected as close to the walls as necessary, either an agger, or a moveable tower, according to circumstances.

Offensive weapons of the ancients.

Mining.

Such were some of the defensive works used by the ancients in carrying on a siege, or in making a sudden attack on a fortified place. Of their offensive weapons, we have already given an ample account under the articles **Arms** and **Artillery**, to which we refer our readers. Of the methods employed by the besieged for destroying, and otherwise rendering unserviceable, the machines of the enemy, we have also spoken under the article **Archimedes**, where we took occasion to state our opinion with regard to the wonderful power ascribed to the mechanical inventions of that distinguished mathematician. We would only observe farther on the subject of ancient fortification, that *mining* seems to have been practised at a very early period, and with considerable success, especially in destroying the towers and aggera of the besiegers. The earth under these works being excavated, the place was filled with combustible matter, and set on fire. The superincumbent earth was thus rendered friable, and sinking down, the towers were overturned.

Progress of fortification in modern times.

The invention of gunpowder, (anno 1330,) though ultimately destined to produce a revolution in the system of defending and attacking fortified places, was not immediately productive of this effect. When great guns began to be first used, they were so rude and unmanageable, that the battering engines of the ancients long maintained their ground. Even so late as the beginning of the 15th century, few towns had been regularly bombarded, though artificial fire works had been frequently used, sometimes in the form of rockets, and sometimes fastened to birds tails, for the purpose of setting fire to such parts of the town or camp as were of a combustible nature. It was a device of this kind, that proved fatal to the camp of the Austrians before Saas.

Use of great guns.

About the beginning of the 16th century, the use of great guns became more common, and their effects began to be more apparent. The circumvallations of the besiegers gradually assumed the form of regular fortifications; and fortified places themselves underwent a considerable change both in form and strength. We cannot here enter into a detail of these changes, without supposing our readers to be acquainted with the principles of the art, which it is the object of this article to explain. It may, however, be observed in general, that the use of modern artillery had not of itself the effect of shortening the duration of sieges. The advantages of great guns, especially after men had acquired considerable dexterity in the management of them, were no doubt very great to the besiegers; but they also afforded to the besieged a powerful means of annoying the enemy. Besides, fortified places were sometimes so successively strengthened, as for a long time to defy even the force of the heaviest ordnance. A wall at Magdebourg, received 1550 cannon shot without sustaining any damage. The numerous instances too, which history affords of long and unsuccessful sieges, even after the invention of fire arms, prove that this invention was not more advantageous for attacking than for defending fortified places. The siege of an important place was almost decisive of the fate of the war, and if not successful on the part of the besiegers, generally terminated in the loss of the greater part of their army.

Change [illegible]

Such was the state of fortification, when, towards the end of the 17th century, M. Vauban effected a complete revolution in the art. This celebrated engineer invented a new method of attack, against which no mode of defence hitherto adopted has been able to hold out. Vauban himself indeed soon discovered the superiority of his system of attack to that of his defence, and, during the latter part of his life, endeavoured to restore the equilibrium which he had destroyed. His disciples, as well as those who differed in some points from him, continued to labour in the same cause; but after all the changes and improvements which they introduced into his plan of defence, it was found, that they had done nothing to counteract the power which had been put into the hands of the besiegers. That power was soon pronounced to be irresistible, and at the same time so regular in its operations, that the duration of a siege was calculated as easily, and in many cases as accurately, as a question in dynamics. Such calculations applied to the operation of moral causes, may indeed seem very absurd; but so deeply have engineers been impressed with the idea, that it is utterly impossible to hold ou against the modern system of attack, that a siege generally terminates after a certain progress has been made by the besiegers, whatever may be the means of defence which the garrison still possesses. Such a system appears to be an agreement entered into among belligerent powers, to deliver up to one another fortified places at a certain price, and certainly has a tendency to suppress that fortitude and determined spirit of resistance, which the history of ancient, as well as of some modern sieges, has proved to be the chief cause of a long and successful defence.

In the remaining part of this article, we shall endeavour to lay before our readers a complete account of the modern plan of fortification, with the art of attacking and defending fortified places. In this account we shall take an opportunity of noticing the various improvements which have either been proposed, or actually adopted; and among others, the plan of defence recommended by Carnot, who has long been distinguished by mathematical, political, and military talents, and well known for his famous defence of Antwerp, in 1818.

PART I. ON THE CONSTRUCTION OF FORTIFIED PLACES.

Permanent Fortifications.

SECT. I.

Permanent Fortifications.

igure of a gular fortication.

EVERY fortified place is in the form of a polygon, more or less regular according to circumstances. The sides of this polygon may be considered as chords of the arches of a circle described about the place, and on the relative length of these chords the strength of the place may, in particular cases, very much depend. The lines which form the plan of the fortification, as described on the ground or on paper, are called the *trace*, and the height to which it is carried the *relief*.

ATE LVII. g. 1.

finitions.

In Plate CCLVII. Fig. 1, is exhibited the trace of a regular fortification of five sides, in which DEFGH is called the exterior, and KLMNI the interior polygon. The distance from A to the angle of the exterior polygon is called the *great radius*, and from A to the angle of the interior polygon the *small radius*. The part contained between two radii, as EBCF, is called a *front* of the fortification; and a line dividing any of the works into two equal parts, as AE, a *capital* line. The fronts of fortifications consist of bastions and curtains. A *bastion* is the part about the angle of the polygon, as VUFZC. The *curtain* is that part of the front which joins the bastions, as BC. In the bastion VUFZC, the lines VU, ZC, are called the *flanks*; and UF, FZ, the *faces*. Bastions which have no flanks, but have their faces produced till they meet the curtain, are called *redans*. This difference gives rise to the two methods of fortification; the *bastion* system, and the system of *Tenailles*, or perpendicular fortification.

When an angle is turned from the place, as F, it is called a *saliant angle*, and *re entering* when turned towards the place, as C. The angle F is called the *saliant*, or flanked angle of the bastion. U, Z, the angles of the *shoulder*; and V, C, the angles of the *flanks*, or re-entering angles. In redans, the angle formed by the face and the curtain is called the *flanking angle*, or angle of the tenaille. When the shoulders of the bastion are built in the circular form P, Q, they are called *orillons*, or *tours creuses*. The distance between the angles of the flanks, as VC, is called the *gorge* of the bastion; and CM, or MV, the *demi-gorge*. A straight line, drawn from the saliant angle of one bastion to the angle of the flank in another, as FB, is called *a line of defence*. If this line be drawn along the face, and parallel to it, it is called a *razing defence*; and if the line make an angle with the face, the defence is said to be *fichant*, or oblique. When the line of defence meets the curtain short of the extremity, the part of the curtain between that point and the extremity is called the *second* flank.

The whole circumference of the works about a town, as represented in Fig. 1, is called the *enceinte*, or *corps de la place*. Other works have each a particular name; but they are in general called *outworks*. The chief strength of the corps de la place, as well as of the outworks, is a mound of earth called the *rampart*, and of which the trace shows the thickness at the bottom. On the top of the rampart is raised another mound, called the *parapet*, for the purpose of covering the besieged and their guns from the fire of the enemy. Behind this, are two or three steps called *banquettes*, on which the soldiers stand when they fire over the parapet; and between these and the town, is a passage called the *terre-plein*, of sufficient breadth for the movement of troops, and the conveyance of cavalry from one place to another. The rampart is generally lined with a wall, called a *revetement*, on the top of which is a passage round the parapet of about two feet in breadth, called *the way of rounds*. The sloping surface of a work is called the *escarpe*, if it declines from the place; and if it inclines towards it, the *counterscarpe*.

Before the rampart in all works, is a ditch called the *fossé*, made by excavating the earth for the rampart. Round the counterscarpe of this ditch, and at a convenient distance from it, is cut out a passage called *chemin-convert*, or the covered way. From the parapet that defends this, the ground declines by a gentle slope towards the field, and is called the *glacis*.

The *command* of a work is its height above the field, or above some other work, and is not to be confounded with *relief*, which is the height above the horizon. When a fortification has only a partial command of the field, it is called a *rasing* fortification; and when it is much elevated above the ground it gets the name of a *high fire*. If any part of a fortification cannot be seen from the parapet, it is called a *dead angle*.

The profile of a fortification, is a vertical section of the works from the extreme boundary of the glacis to the town, or the inside of the terre-plein. The object of a profile, is to exhibit the altitude and depression, as well as the internal structure of the different parts.

Errard's rules.

Various rules have been laid down by different writers, for determining the most advantageous proportions of the parts now defined. The following were given by Errard:

1st, That the saliant angle of the bastion should never be less than 60°, and always 90° when practicable.

2d, That a flanking and a flanked part should be within musket shot of one another, viz. from 700 to 900 feet.

3d, That every part of a fortification ought to be flanked, or seen from some other part.

4th, That all flanking parts ought to be so strong, as to resist the force of ordnance.

5th, That all the works of a fortification ought to be so proportioned in elevation, that the one nearer the place shall be higher than the one before it.

Defects in Errard's method.

Notwithstanding the excellence of these rules, however, the *trace* of Errard was very defective. He left all the lines to be determined by the constructor; the flank was given, but varied with the sides of the polygon, and, on irregular ground, was difficult to be traced. It was also too small, and rendered less easy to be defended, from being perpendicular to the face. Succeeding engineers corrected these faults, by determining the various parts with more precision, and on more accurate principles. The improvements which followed, were adopted partly in one country, and partly in another, and thus gave rise to the different methods known by the French, Italian, Spanish, and Dutch. These methods, however, may be considered as essentially the same, the difference among them being chiefly in the saliant angle of the bastion, and the form of the flank.

Whatever method of fortification be adopted, it is of importance to observe, that all the works ought to be traced out in the exterior polygon. If they are traced on the interior, the different points will not be determined with the same accuracy. Having premised this, we proceed to lay down the rules for the most approved method of fortifying as it is now practised.

Rules at present observed.

The gorge of the bastion should never be less than from 160 to 200 feet wide, so as to afford a free communication with the bastion, and room for mounting two or three guns.

The length of the flank depends on the length of the line of defence, and what it is required to defend; but it ought never to be less than from 180 to 200 feet, and should be perpendicular to the face which it is intended to flank.

The orillon should never be larger than to allow two or three guns to be placed on the covered plank. If it be more, it weakens the flank.

Casemates.

To increase the offensive power of the flanks, guns have sometimes been placed in vaults cut out of the rampart beneath. These vaults are called *casemates*; but they have been objected to on account of their diminishing the strength of the flank, their annoying the gunners with smoke, and being very expensive. To remedy these defects, and, at the same time, to reap the advantages of an auxiliary fire, lower flanks have been constructed before the other flanks, and behind the orillons. In these, the ordnance is covered by a parapet, and the ammunition is placed in a vault under the parapet of the higher flank. Compared with casemates, these lower flanks are undoubtedly an improvement, but, at the same time, they certainly diminish, in a considerable degree, the effect of the higher flank; and it may therefore be justly questioned, how far they are, in many cases, advantageous.

The saliant angle of the bastion ought never to be less than 80 degrees, and if it could be made to exceed 90, it would give to the whole work a still more advantageous form. The flanked angle would be thus enlarged, the flanks lengthened, the faces more parallel to the field, and the bastions themselves might be at a greater distance from one another.

The length of the faces is determined by that of the curtain and the side of the polygon, but in no case ought it to be more than 350, or less than 230 feet.

The curtain should never exceed 500 feet, nor fall short of 200.

Fossé.

The depth of the ditch or fossé generally depends on the nature of the ground, and the quantity of earth required for the rampart. Its width must also be determined by circumstances, but ought never to exceed 100 or 130 feet. The ditch ought always to be dry when there are no outworks.

Covert way.

The covert way is of great use in preventing the enemy from approaching too near the ditch, and obliging them to be more watchful in guarding their works, while, at the same time, it enables the besieged the more easily to defend their outworks, as well as to collect their troops in safety when they intend to make a sally. The covert way is parallel to the counterscarp of the ditch, and varies in breadth from 30 to 48 feet according to circumstances. In all cases, it should be of such a width as to allow the troops to form and manœuvre without disturbing those who may be defending it. In order to give every part of the fortification a complete command of the glacis, the angle which the plane of the latter makes with the horizon, ought to be such, that if the plane were continued, it would pass through the highest part both of the outworks and the enceinte.

Places of arms.

Demi-lunes.

Plate CCLVII. Fig. 2.

The space A′ in the re-entering angle of the covered way, is called a place of arms, of which the faces or lines forming the saliant angle are from 60 to 100 feet in length. A similar space in the saliant angle of the covered way, is called the saliant place of arms. Such places were found to be of great use in defending the covered way, but were soon rendered much more so by surrounding them with a ditch distinct from the covered way, and on the escarpe of that ditch constructing a rampart for the defence of the men within. In this form, the work is called a *demi-lune* or ravelin, as ADCB, Fig. 2. The original design of the demi-lune was principally to defend the gates of the fortress and the bridge before them, so as to prevent either from being taken by surprise. By enlarging their size, however, they were found to be more extensively useful and they have long been considered as essentially necessary for all curtains. Their principal advantages are obstructing the enemy's view of the bastion, and commanding the glacis, so as to prevent the erection of works in two positions very advantageous for attacking both the flanks and faces.

Different positions of demi-lunes.

Some engineers have preferred placing the demi-lunes before the bastions, as better calculated from their size to retard the progress of the besiegers, and affording, from their position, the means of flanking the works constructed by the enemy for attacking the faces and flanks. This position, however, is liable to several objections. It leaves the gates, curtains, and even the flanks more exposed. The communication with the rampart is less secure, and from the difficulty of flanking them, the demi-lunes themselves are easily taken. By modern engineers, they have accordingly been completely rejected.

PLATE CCLVII. Fig. 2.

In the construction of demi-lunes, some have given them their defence from the curtain, as ADC, Fig. 2, where EF, GH are from 48 to 60 feet, and the faces of the ravelin 130 to 180. Others have taken the defence from the orillons, as IDK, where the faces are from 200 to 230 feet. Sometimes also they have been constructed in the form LDM; but all these forms are inferior to what will be described afterwards.

Demi-lunes are surrounded in the same way as the enceinte, with a ditch and covered way, the former being from 48 to 60 feet wide.

Fausse-brave.

A second enceinte, called the *fausse-brave*, has sometimes been constructed around the first, having a terre-plein of from 16 to 24 feet on a level with the field, and defended by a parapet. This work doubles the fire of the enceinte, and, from its low and grazing direction, affords a better defence to the covered way and fossé. It scarcely holds out, however for any length of time after the glacis is taken, and is besides liable to many objections. It assists the enemy in mounting a breach, and the deserters in making their escape; affords shelter to the enemy's reinforcements, and covers their miners while at work. It was formerly much used by the Dutch; but, in modern fortifications, is seldom adopted.

agan's ethod.

The method of tracing out a fortification as decribed above, has undergone many changes, and received considerable improvements since the time of Errard. Of the engineers who immediately succeeded him, Pagan occupies the first place. That writer having witnessed all the wars of Louis XIII. soon perceived that the method of defending a place, had by no means kept pace with the art of attacking, and was, in consequence, led to introduce considerable changes into the position and arrangement of the different works. He fortified on the exterior polygon, the side of which he determined to be from 900 to 1150 feet. From the middle point of the side, he erected a perpendicular towards the centre of the place, from 120 to 170 feet. Lines drawn through the extremity of the perpendicular to the angles of the polygon determined the faces, which he made from 170 to 340 feet. The ditch was parallel to the faces, and 90 feet wide, and the faces of the ravelin were directed to the angles of the shoulders. The ditch before the ravelin was 55 feet, the covered way 30, and the faces of the places of arms 48 to 60. He also laid down as a rule, that the line of defence should not exceed 750 feet, terminating at the extremity of the curtain, and at right angles to the flank.

an's we- in the ite,

Vauban, who may be regarded as the father of the present system of attack, also made considerable improvements in the method of defence. In his trace, the perpendicular is determined by the length and number of the sides in the polygon. If the enceinte be a square, the perpendicular is one eighth of the side; if a pentagon, one seventh; and if a hexagon or upwards, one sixth. The faces are determined as in Pagan's method, and are made equal to two-sevenths of the side. The flanks are at right angles to the line of defence, and the orillons, which are curved outwards, one third of the flanks. The most advantageous length for the side of the polygon is fixed at 1250 feet, and 1000 for the line of defence. This construction possesses considerable advantages over the method adopted by Pagan. It can be more easily adapted to local circumstances, as all the parts diminish with the side and angle of the polygon. The flanks have an advantageous position, and the bastions are more spacious.

in the invention of cavaliers,

Vauban also introduced a change in the construction of cavaliers or mounds of earth raised above the rest of the fortification, for the purpose of commanding a distant part of the field. Formerly these had been placed in the curtain and various other parts of the fortification, and were sometimes used for defending the ditch. In these positions, however, they were found to embarrass the manœuvres of the soldiers. Vauban, therefore, enlarged their size, and placed them in the bastions, whence they could more effectually defend the curtain. They are traced thus: A parallel 36 feet from the interior of the parapet, denotes the exterior side of the talud or slope of the escarpe, and 18 or 20 feet farther back, is drawn the fire-line or interior side of the cavalier. In small bastions, the talud is almost perpendicular, and the earth is prevented from falling down by a revetement. This revetement, however, ought in no case to be higher than the parapet of the bastion, that it may not be seen by the enemy, and that the garrison may not be injured by the splinters. It is also a disadvantage attending cavaliers of this kind, that they prevent the bastion from being intrenched farther back. Nor is this defect remedied by carrying a parapet, as some engineers have done, from the cavalier to the bastion, and constructing a ditch before it, as such a parapet is destroyed as soon as a breach is made. A more advantageous method of constructing cavaliers will be given in a subsequent part of this article.

in outworks,

The improvements which Vauban introduced, were not confined to the enceinte alone. He also made several advantageous alterations in the construction of outworks, though, it must be admitted, that he left not a little to be done in this way by his successor Carmontaigne. The first outwork used by Vauban, is the tenaille *a* C *t*, Fig. 3. It is placed before the curtain, and separated by a ditch sufficiently large to receive the earth that may fall from the curtain, and which might otherwise fill the terre-plein. Of course it, in a great measure, supersedes the use of the fausse braye. In his first tenailles, Vauban used flanks, as *b e*, *g f*, though they were afterwards omitted. In constructing tenailles of this kind, *h i*, *e f* are parallel to the curtain, the first at 16, and the last at 60 feet distance; *a k*, *t l*, 30 feet from the flanks of the bastion; *a b*, *t g*, equal to one-half of *a* C or *t* C; and the flanks *b e*, *g f*, parallel to those of the bastion. Having determined *a b e*, and *t g f*, there are drawn parallel to these, and at the distance of 54 feet, *a k h* and *t l i* for the interior side of the terre-plein. Thus the terre-plein of the faces and flanks of the tenaille is 30 feet, but that of the curtain only 18.

in the invention of tenailles. PLATE CCLVII. Fig. 3.

In constructing tenailles without flanks, which are found to be most advantageous, the flanks being easily destroyed, the faces *a b* and *t g* are continued till they meet opposite the centre of the curtain. By this form, the tenaille is not enfiladed, and the besieged may retain it even after the fossé is taken. The form would be still farther improved, if, instead of forming an angle *a* C *t*, it were parallel to the curtain. It would thus afford a direct fire on the terre-plein of the ravelin, and allow the ditch to be made larger.

Advantages of the tenaille.

The tenaille answers several important purposes. It covers the sally ports of the curtain and flanks, by which the besieged communicate with the ditch; preserves a communication with the ravelin, and secures the retreat of those who defend it; protects the men in the fossé when dry, and the boats when wet; affords a razing fire on the enemy when crossing the ditch, and covers the revetement of the curtain to a certain height. It is also of great use in case of a breach being attempted in the curtain, which is generally done when the resistance is obstinate.

Some engineers make no ditch between the curtain and the tenaille; but this is obviously an error, as the earth, falling from the curtain into the terre-plein of the tenaille, would greatly facilitate the operations of the enemy in making a breach; and the communication with the body of the place would also be more difficult, that communication being chiefly by vaults, which ought to be covered by the parapet of the tenaille.

Vauban's improvement in the demi-lune,

In constructing ravelins according to Vauban's method, the faces produced terminate on the angle of the shoulder, if the bastion has flanks with orillons; but if the flanks are straight, the faces of the ravelin terminate on those of the bastion 30 feet from the shoulder. The object in both cases is to cover the flanks completely, and to give the faces of the bastion a better command of the ditch before the ravelin. The angle formed by the face of the bastion and that of the ravelin ought to be as acute as is consistent with the best defence. In Vauban's method, this angle is always obtuse, and the face of the ravelin was at first equal to one fourth of the side of the polygon. Finding, however, that the shoulders were still very much exposed, he enlarged the angle by extending the faces of the ravelin to one third of the side of the polygon, and making them terminate on the faces of the bastion 90 feet from the shoulders. He sometimes also used flanks to his ravelin as *o p*, sufficient for mounting two guns, taking *q p* equal to 42 feet, and *p o* equal to 60. These flanks, however, are of little use, as they are easily enfiladed by the enemy, and afford little protection to the curtain.

Formerly the faces of the ravelin terminated on the counterscarpe of the ditch, in the re-entering angle of which a small harbour was constructed for the boats that were used to keep up the communication between the ravelin and the place. In this form, however, the back part was found to be easily enfiladed, and now the faces terminate on the lines A*m*, B*n*, drawn from the saliant angles of the bastion to the end of the terre-plein.

in constructing reduits,

As an inducement to hold out in defending the ravelin, which is too frequently given up without necessity, Vauban constructed reduits within the ravelin. These consisted at first of a single wall, two feet thick, and from six to seven feet high, and were intended to cover the garrison in retreating from the demi-lune in case the latter were taken. They were of the same form as the demi-lune, their faces being 80 to 120 feet, and their flanks, where the ports were, 30 to 48 feet. They were separated from the terre-plein of the demi-lune by a ditch 12 to 16 feet wide.

When large demi-lunes were invented, reduits were converted into second demi-lunes, having faces 100 to 130 feet, and separated from the first by a fossé. This work has been found very useful in defending the breach, as well as the passage of the ditch. The width of the ditch before the curtain is from 100 to 130 feet, round the bastion 100 to 110, and before the ravelin 60 to 80. The saliant parts of all ditches are circular, described from the saliant angle of the work with a radius equal to the width of the ditch.

in the covered way.

But the greatest of all Vauban's improvements was in the covered way. He constructed the places of arms with faces from 72 to 100 feet, and forming an angle with the covered way of 100 degrees. He also constructed traverses or parapets across the covered way, which prevented the latter from being enfiladed, and secured a retreat to those who were defending it. The traverses were perpendicular to the counterscarpe, and 90 to 100 feet distant from each other. A coupure or passage round these, sufficient to let two men pass together, was cut out of the glacis. By these improvements, simple as they may appear, Vauban contributed not a little to the great object of all fortification; an object that the older engineers sometimes lost sight of, that of enabling a garrison to prolong its defence.

Carmontagne's improvements.

At a later period, Vauban's method of constructing outworks was considerably improved by Carmontagne. By enlarging the reduit, he diminished the terre-plein of the demi-lune, which in Vauban's system was too large. He made the ditch between the demi-lune and the reduit 55 feet, and constructed the latter so as to make its flanks about 55 feet, terminating in the same way as Vauban's. He also constructed larger works in the places of arms. The principal of these was a reduit D, of which the faces *r s*, *s u*, formed a very obtuse angle, and the flank *v*, prevented the part of the covered way behind from being enfiladed. These flanks serve also to take the enemy in the rear when attempting to ascend the breach in the demi-lune.

Most approved form of the demi-lune.

Ravelins might be still farther improved, by increasing the saliant angle so as to lengthen the faces; but as that angle ought never to exceed 60 degrees, the most advantageous form for a ravelin, is an equilateral triangle. The advantages of the ravelin, however, depend not a little on the angle of the polygon. The larger that angle is, the farther will the ravelins extend into the field, and of course the greater will be their command. This, indeed, is the principle on which all the modern improvements in fortification are founded, and for the illustration of which we are chiefly indebted to St Paul, the inspector general of the French fortresses. We say *illustration*, for the discovery, we believe, is due to Montalembert and Belidor, particularly the latter.

The practice of enlarging the angle of the polygon has been adopted by succeeding engineers, not only from the advantageous position which it gives to the demi-lune, but also because it is found to form the strongest possible enceinte. The proper application of this principle, and the late improvements in the construction of works in the places of arms, constitute the chief merit of the modern system of defence.

Montalembert's method.

In Montalembert's method there are no bastions, but merely saliant and re-entering angles, the former 60 and the latter 90 degrees. His lines of defence, that is, the lines containing the angles, are from 300 to 550 feet.

Thickness of the different works

In the preceding part of this article, we have considered the trace merely as a suite of lines, without regard to the thickness of the works which these lines represent. We shall now proceed to lay down the dimensions of the different parts, as they have been determined by the most skilful engineers.

Rampart.

The terre-plein of the rampart ought to be of such a breadth as to permit the soldiers to manœuvre, and effectually to resist all attempts to make a breach in it, at the same time if it be too wide, it is much exposed to the enemy's fire, occupies more space than can be spared from the other works, and becomes very expensive. By some old engineers it was fixed at from 55 to 70 feet, a breadth often impracticable, and in all cases useless. Pagan reduced it to 25; but unless the quantity of artillery be very small, and the guns seldom require to be removed from one place to another, this space is too narrow. A piece of ordnance after being discharged, recoils from 18 to 25 feet, according to its calibre and the nature of its mounting. The breadth of the terre-plein, therefore, cannot be less than from

33 to 40 feet, without embarrassing some part of the service. Perhaps 36 feet is the best medium.

To prevent the rain lodging upon it, the surface of the terre-plein should incline towards the town at the rate of one inch of perpendicular descent in every foot of breadth. It ought also to be planted with rows of trees, particularly oak and elms, for the purpose of supplying wood for the artillery engines and carriages. The mass of the rampart is to be finished towards the town by a talud or slope, not, however, so steep but that the soldiers may ascend it without being obliged to go round by the ramps or passages leading up to the terre-plein. Between the houses and the rampart, there ought, if possible, to be a street 14 to 20 feet wide; and if there is not space sufficient for this otherwise, the inner side of the rampart may be made more nearly perpendicular, and be supported by a revetement. It is always inconvenient to have houses close to the rampart, and ought therefore, if possible, to be avoided.

astions.

Engineers have differed in opinion with regard to the construction of bastions, some recommending the full, others the empty. The former are those in which the ground within is level with the rampart, the parapet only being higher; the latter are such as have the ground considerably lower. The empty bastions, it is said, afford facilities to the garrison for carrying on their mines, and the interior space is well adapted for magazines. The full bastions, however, are now generally preferred, except in cases where there is a scarcity of earth, as they are better calculated to resist an assault, while in the empty bastions the magazines are much exposed to the enemy's shells, and the entrenchments within are incapable of a great resistance.

valiers.

ATE
LVII.
. 3.

The principal work constructed in the bastion, as formerly mentioned, is a cavalier. The most approved form of this work is represented in Fig. 3. where E, F denote the terre-plein of the bastion 36 feet in breadth, *w x y* a line parallel to the faces of the bastion, and forming the escarpe of the faces of the cavalier, from which it is 30 to 36 feet distant, and GHI the parapet. The coupures *z w*, *z y* are perpendicular to the faces, and 20 to 30 feet distant from where the face of the ravelin terminates on the face of the bastion. These coupures cover the terre-plein, from which alone the work can be taken. The communication between the cavalier and the interior, is by means of steps behind the faces, so placed as to be covered from the enemy's fire.

ette.

Another kind of cavalier called a *barbette*, is sometimes constructed in the saliant angle of the bastion, as *a*, extending about 36 feet along the faces. The terre-plein of the barbette is about 2½ lower than the parapet of the bastion; 24 feet in breadth, and has ramps at each end, for bringing the guns upon it. The chief advantage of the barbette is, that their fire may be directed to any point where it may be most effectual in annoying the enemy.

et.

As the object of the parapet, in all works, is to cover the besieged on the rampart, it ought to be of a sufficient height and thickness for that purpose. It has been found that a twenty-four pounder fired against a parapet, at a short distance, penetrates about 11 feet in hard ground, 13 in middling, and 16 in loose earth. A parapet therefore ought to be from 18 to 20 feet in thickness. The practice of raising the revetement as high as the parapet is now abandoned, and the exterior talud or slope is finished with gazons or turf, having a base equal to its height, or half its height, according to the nature of the materials. The interior of the saliant angle is sometimes made circular, to admit a greater number of men than it could otherwise do. The height of the parapet above the terre-plein ought to be 7 feet 6 inches, and the banquette about 3 feet; that is 4 feet 6 inches lower than the highest inner edge of the parapet. When the banquette is higher than 2 feet, it ought to be provided with steps for the soldiers to ascend. Its breadth should be about 4 feet, to allow two ranks of soldiers to act. As a banquette is not on all occasions useful, it may sometimes be sufficient to have a mound of earth behind the parapet, ready to be constructed should it be necessary.

Plonge of the parapet.

In order to give the fire of the garrison a complete command of every part of the field, and the enemy's works, the parapet has a slope outwards. To determine this slope, which is called the *plonge*, is always a problem of great importance. If the parapet be too level, the guns of the garrison cannot be brought to bear on such of the enemy's works as are very near; and should the slope be very great, it weakens the upper part of the parapet. The plonge, that is the vertical difference between the interior and exterior edge of the parapet, should not therefore if possible exceed 18 inches, but, at the same time, it ought to be so constructed as that the garrison may completely command the covert way and glacis.

Embrasures.

The guns of the garrison are fired through openings in the parapet, called *embrasures*. These openings are not made when the parapet is at first constructed, but are generally left to be cut out as the position of the enemy's batteries and other circumstances may require. The form of embrasures has undergone various changes, but that now generally adopted is from six to nine feet in width towards the field, and from 16 to 18 inches towards the place. The best method of supporting the sides of the embrasures is by means of saucissons or large fascines. Wood and stone are sometimes used, but are dangerous on account of the splinters. The part of the parapet between two embrasures is called a *merlon*. Revetements should never be carried so high as to interfere with the embrasures; nor should trees be planted near them, as the roots become very troublesome. When, from a scarcity of earth, it becomes necessary to construct the whole or any part of the parapet of masonry, it ought to be from four to seven feet in thickness.

Passage of the rounds.

In former times, it was usual to carry a passage round the outside of the parapet, on the top of the revetement, from 6 to 10 feet wide, with a wall from three to six feet high towards the field, in which were loop-holes for the soldiers to fire through. This passage, commonly called the *passage of the rounds*, is now completely abandoned, having been found to afford considerable facility to the enemy in making an assault. Guerrites, or small towers before the saliant angles of the parapet, for centinels, have also been given up.

Ramps.

As a free communication among the different parts of the fortification is of the greatest importance, it becomes necessary to have ramps or slopes, by which the artillery, &c. may be brought upon the rampart. If the bastion be full, ramps in the gorge will be sufficient; if empty, one will be required at each flank, at the faces, and also at the curtains. The breadth of the ramp may be from 10 to 19 feet, according to circumstances; and its perpendicular ascent, from 1 inch to 2½ inches per horizontal foot.

Souterrains.

Souterrains, or caserns, are places constructed under the rampart, for the purpose of lodging the soldiers, and containing ammunition, &c. The invention of shells has rendered souterrains much more necessary now than they were in former times. They are most advantageously placed in the curtains and cavaliers, as being there least exposed to the enemy's fire. Their sizes are different, according to the purpose for which they are intended. Such as are intended for powder-magazines, ought to be in a dry place, and as far as possible from buildings. It is calculated that 18 tons of powder occupy a space of about eight cubic yards.

Gates. Gates, in a fortified town, should be as few as possible, to save the garrison unnecessary duty, and to prevent the expence of keeping bridges in repair. Gates are generally placed in the curtain; and, according to Carnot, ought to be 9 to 10 feet in width, and 13 to 14 in height. They are shut by a draw-bridge, and also by a strong door at each extremity of the passage. On the right and left of the gate, and within the town, are watch-houses for centinels, which ought to be shell-proof. Formerly, the bridges before the gates were of wood, but in the new fortresses they are of stone. The former had the advantage of being easily burned, in case of emergency.

Posterns. In those curtains that have no gates, there are subterraneous passages called *posterns*, which communicate with the ditch by two flights of stairs or ramps. They are useful in holding ammunition for the outworks. The extremity next the field ought to be covered by a tenaille, or closed up by a very strong gate.

Comparative merits of wet and dry ditches. Engineers have differed in opinion with regard to the comparative merits of a dry and a wet ditch. There can be no doubt, that one capable of being made either dry or wet, according to circumstances, is to be preferred: at the same time, it seems to be generally admitted now, that a dry one is the more advantageous, particularly if the enceinte has a revetement. It not only enables the garrison to lend more prompt and effectual assistance to the outworks, but it also encourages the defenders of these to maintain their position with more obstinacy, knowing that they have a ready and safe retreat in case of extremity. Besides, it is only in a dry ditch that the garrison can make sorties, the communication by means of boats being altogether unfit for rapid movements.

Caponniers. **PLATE CCLVII. Fig. 3.** In a dry ditch, the communication between the fortress and the ravelin consists of a passage *b*, Fig. 3, about nine feet wide, and inclosed by a parapet on each side, terminating in a glacis. A passage of this kind is called a *caponnier*. When they have a parapet only on one side, they are called half caponniers. Both kinds are sometimes carried between the shoulder of the bastion and the ravelin, as well as between various other parts of the fortification, and are useful in defending the ditch. They are always perpendicular to the lines which they enflank.

Cunette. In moist ditches which are intended to be dry, it is frequently necessary to have a small ditch called a *cunette*, for carrying off the superfluous water. It is also sometimes used to prevent the enemy from surprising a work that has no revetement or wet ditch. In this case, it is 8 feet deep, and 12 wide.

Batardeaux. If a place be so situated, that a current of water can be brought through the ditch at pleasure, it gives the garrison a prodigious advantage over the besiegers, and always obliges the latter to be very cautious how they cross the ditch for the purpose of making an assault. In order more effectually to inundate the ditch, **Fig. 1.** dams or batardeaux, *a b*, *c d*, Fig. 1, are sometimes employed. They are constructed of stone, and of a sufficient thickness to resist the pressure of the water contained in them. The water is admitted and discharged by means of sluices, from which it flows over a long slope, so as not to injure the bottom of the ditches. Batardeaux ought to be constructed in places as much as possible without the reach of the enemy's fire; and the sluices ought to be well protected. When the batardeau is constructed before the curtain, it serves as a communication between the place and the ravelin, by means of a gallery in the interior.

Tenailles are generally 50 feet in width, having a parapet on the escarpe, and a terre-plein of 25 feet. Underneath, they have posterns similar to those in the rampart, in the outer extremity of which may be constructed a convenient harbour for small boats, when the ditch is wet. In the gorge of the tenaille, on each side of the postern, is a flight of stairs.

Simple and composed demi-lunes. Demi-lunes are called *simple* when the interior is empty, and *composed* when they have reduits within. A simple demi-lune consists of a parapet only, or a rampart with a parapet upon it. The width of this rampart ought to be about 50 feet, which will leave 30 feet for the terre-plein, after a parapet has been constructed. The ramps of the terre-plein are in the saliant angle. Demi-lunes are sometimes furnished with posterns, which serve for a communication with the places of arms when the ditch is wet, and for sally ports when the ditch is dry. They are generally in the saliant angle. The gorge of the demi-lune ought to have a revetement with a small harbour, and ramps or stairs.

Dimensions of reduits. The reduit of a demi-lune ought to have a rampart of 50 feet wide, with a parapet, and ramps at the extremities of its faces. If the ditch before it be dry, it ought to be from 9 to 12 feet higher than that of the enceinte. The stairs between the two ditches ought not to reach to the bottom of the lowest, lest they facilitate the attack of the enemy. The communication for the garrison may be completed by wooden stairs, to be removed when not to be used. On the ramparts of demi-lunes and reduits, trees ought to be planted, as formerly mentioned, with regard to the body of the place. They render it more difficult for the enemy to effect a lodgement there. In the saliant angles of the ravelins, there ought always to be barbettes; and the counterscarpe should have a revetement of from 10 to 12 feet.

With regard to the communication between the higher and lower parts of a fortification, it may be observed, in general, that ramps are more advantageous than stairs, the latter being more easily destroyed. Sometimes, however, it is impossible to have ramps.

Traverses. Traverses ought to be about 10 feet in thickness, with two passages, one towards the glacis, and another in the counterscarpe. To prevent the covered way from being enfiladed, the glacis has a crotchet *c d e f*. Traverses have in general banquettes, from which the covered way is defended, and which are as high as the crest of the glacis. Sometimes the banquette is carried across to the counterscarpe, leaving only one passage at the extremity of the traverse next the glacis. In the faces of the places of arms, there are ramps to facilitate the sorties, about 10 feet wide, and so steep as to prevent their being enfiladed. These ramps ought to be at some distance from the saliant angle, where they would be too much exposed. The passages from the gates through the glacis are from 12 to 18 feet wide, the sides of the glacis being lined with walls, and the whole constructed so as nowhere to expose the covered way.

Improve-
nents in the
lacis.

It has been proposed by some to cover the glacis with stones, or plant it with brush-wood, to prevent the enemy from making excavations. Perhaps the same purpose would be better accomplished by planting it with trees. This last method was adopted by the French engineers subsequently to 1792. Another improvement in the construction of the glacis, is to round off all the angles, except such as are saliant, by which means the places of arms are rendered more capacious, and the lines are less liable to be enfiladed. This practice was first recommended by Fontalard.

ituation of
sterns.

The postern in the places of arms which communicates with the covered way, ought to look towards the bastion, because, if it were on the opposite side, it would be exposed to the enemy's fire, whenever they get possession of the saliant angle of the ravelin. The communication between the covered way and the ditch is formed by ramps in the counterscarpe of the places of arms.

Such is a general outline of a complete fortification according to the modern system of defence. A fortified place, however, when finished, seldom presents so simple a form as what we have now described, being generally surrounded with a great variety of other outworks. The nature and use of these we shall now proceed to consider.

aillons.
TE
.VII.
4.

A tenaillon is a kind of couvre face A, Fig. 4. constructed on each side of a small ravelin B, to increase its strength, and cover the shoulder of the bastion. To trace a tenaillon, produce the face of the ravelin, and, leaving from 60 to 80 feet for the fossé, set off *a b* equal to 180 feet. On the counterscarpe of the bastion, set off *c d* equal to 90 feet, and *a b d c* will be the tenaillon. Works of this kind are sometimes a little different from that represented in Fig. 4. But it may be remarked of all of them, that they are much inferior to large ravelins. They are in consequence very seldom adopted.

er-
s.

Counterguards are works placed sometimes before the bastion, and sometimes before the ravelin: but the latter position is now generally preferred, as they thereby answer the purpose of large demi-lunes. A counterguard before the ravelin is represented in Plate CCLXI. Fig. 1. where AB is equal to about 240 feet, and CD about 60. A counterguard before the bastion does not afford sufficient protection to the shoulder, and is, besides, one third more expensive than that before the ravelin. At the same time, it may be of essential service in that position, especially if the revetement of the bastion be very high compared with the covered way. Counterguards should have a revetement all round, as high as the terre plein, with a fossé from 70 to 90 feet wide. It will also increase the strength of the work, to have a coupure *a b* before its reduit, with a fossé 20 to 24 feet wide lined on both sides with a revetement up to the terre plein. Under the parapet of the coupure is a postern, with stairs to communicate with the counterguard. The ditch of the coupure ought not to be so deep as the large ditch by six feet, if both are dry; but if the great ditch be wet, the bottom of the small ditch will not require to be more than one foot above the highest water. The revêtement, from the bottom of the ditch of the coupure ought to be at least 10 feet high, to prevent a surprise in case the enemy should get possession of the place of arms E. Coupures in general should be perpendicular to the faces, and so laid as that the enemy cannot batter them from the covered way. They should also be placed near the extremity of the terre plein FG towards the enceinte, that the communication with the latter may be the better secured.

E
III.

Avant
fossé.

When there is a scarcity of earth, a ditch is sometimes constructed before the covered way, or rather before the glacis, called the *avant fossé*. It is not, however, of much use, unless it can be made wet and dry at pleasure, and is rather incommodious to the soldiers when making a sally.

Avant-
covered-
way.

The avant-covered-way is a second covered way before the first or before the avant-fossé; but is useful only in large fortresses, which have numerous garrisons. It is constructed in the same way as the first, care being taken that the fire of the latter is not interrupted by the former. The avant-covered-way communicates with the works behind by means of bridges or caponniers, the inner extremity of which terminates in the places of arms.

Fleches.

Fleches are works of two lines or faces, forming an angle, and generally constructed over saliant angles. They are sometimes useful in covering a passage, but in general they are incapable of making any resistance.

Lunettes.
PLATE
CCLVIII.
Fig. 1.

Lunettes are works resembling ravelins, but consisting only of a parapet, placed opposite the saliant angle of the covered way, as H and K, Fig. 1. If the covered-way has an avant-fossé, the lunettes are placed in the fossé; but if it has none, they are constructed at the foot of the glacis, as H and K, Fig. 1. When surrounded by a ditch and covered-way, they form an excellent defence; and, by obliging the enemy to open his works at a greater distance from the place, they essentially prolong the siege. They are also useful in sorties.

Lunettes ought not to be placed too far from the enceinte; their angles should be at least 60 degrees, that it may be defended by guns; and the faces from 100 to 200 feet long. They are always of the greatest advantage, when the angles of the bastions are very open. The most advantageous arrangement of lunettes, and that by which they best defend one another, is where the straight lines joining them make saliant and re-entering angles alternately; the saliant before the ravelin, and the re-entering before the bastion. In this way, too, the greatest number can be made to defend one bastion, all which must be taken before the bastion itself be assaulted. Flanks of from 50 to 60 feet are necessary in lunettes. The angles of these flanks increase as that of the bastion diminishes, and *vice versa*.

The communication between the lunette and the covered way. is by means of caponniers; but lest these should be occupied by the enemy, a subterraneous passage from the counterscarpe of the covered way, to the gorge of the lunette, is preferable. If the communication is not covered, it enters the gorge by steps; if it is subterraneous, the gorge is straight, and the steps are in the middle of the lunette. If the terre-plein of the lunette is not higher than the ground, the gorge must be protected by a wall, with loop-holes, at least 6¼ feet high, and 12 to 20 inches thick. The covered way and glácis round the lunettes, are constructed in the same way as before the enceinte.

Horn
works.
Fig. 2.

A horn work is represented by ABCD, Fig. 2, and is constructed as follows. From the saliant E produce the capital, making EF from 450 to 500 feet. Through F draw a perpendicular BC, making BF, CF each from 300 to 350 feet, and on this line construct a front, as on the exterior side of the polygon. Then draw the faces BA, CD directed to a point, about 30 feet from the shoulder of the bastion. If a ravelin *a b c* is constructed before the horn work, its faces ought to be 200 feet. The ditch round horn works is about 72 feet. Various entrenchments, as G and H, have been used to strengthen crown works, but none of them have been of much advantage.

Horn works are placed sometimes before the curtain, and sometimes before the bastion. In the former position, they do not appear to be of advantage, as, in case of their being taken, the enemy becomes master of the whole front. Before the bastion they may be very useful; but in every situation they are liable to strong objections. They require a great number of men to defend them—they form a saliant that is not easily supported by other works—they present a straight front to the enemy, which is always weak, and they are very much exposed to an assault on their wings or faces.

Crown works. PLATE CCLVIII. Fig. 3.

Crown-works differ from horn-works in having a bastion in the middle, as Fig. 3. In other respects, they are the same, and constructed in the same way. They are, however, liable to still stronger objections than horn-works. They are more expensive, and more difficult to defend. They are therefore seldom used, unless it be to cover some large and important position near the fortress.

Detached and isolated works are such as are completely unconnected with the body of the place, and intended to protect or attack some distant position. Their form and magnitude differ with circumstances; but they are always similar to some one or other of the works already described.

Montalembert's caponniers, angular towers, and ravelins with ailerons.

Of the works placed in the ditches, or used as coupures and entrenchments, the most remarkable are Montalembert's casemated caponniers, angular towers, and ravelins with ailerons. The caponniers are large stone buildings, with two or three rows of guns above one another, and between these rows loop holes, through which the soldiers may fire with musquetry. One half of the caponniers may be used as casemates, as the smoke is easily carried off. The whole is covered with a shell-proof covering. The angular towers, or *tours angulaires*, are round buildings, with a stair in the middle, and places all about it for men and guns. The sides are pierced with embrasures and loop holes, and the whole covered as the caponniers are, with a shell-proof covering. On the top is sometimes erected a watch-tower. Under the same denomination of works may be classed the English martello towers, consisting sometimes of several stories, with embrasures and loop-holes. The communication between these stories is by means of ladders. On the top is placed one gun, and sometimes more, the carriage of which moves on a pivot. The ravelins, with ailerons or orillons, do not differ from common ravelins, except that they are smaller, and have the orillons. The latter are sometimes constructed of stone, but more frequently of earth, and are separated from the ravelin by a small ditch. These orillons are of great use in covering the shoulders of the bastion, when the ravelin is too small for that purpose. But in every case it would be better to have a large ravelin without the orillons, than a small one with them. The orillons are in fact a sort of places of arms, which when taken, give the enemy the command of the ravelin.

Advantages of water.

Of all the means of defence, none perhaps can be turned to greater advantage than water, when it can be readily commanded. An inundation, well directed, is not only a defence to the besieged, but may even be converted into a powerful means of annoyance, by suddenly destroying the enemy's last and most important works in the fossés. It is no small recommendation, too, of this method of defence, that it can be used without much expense, either of labour or ammunition.

Casemates.

Casemates have frequently been resorted to as a certain means of defence; but besides the general objection that they are expensive, it does not appear that they are so effectual as might at first be supposed. The most useful works of this kind, are the double caponniers, for the defence of the ditches. These are covered with a shell proof arch, and surrounded with a ditch 12 feet wide, and 6 feet below the bottom of the ditch in which they are placed. The chief object of this ditch is to prevent the enemy's approaching so near as to throw inflammable matter into the loop-holes of the caponniers.

To cover the gorge of a work, a single wall is sometimes constructed with loop-holes, and stairs behind it to communicate with the terre-plein. Perhaps the best defence for any gorge, is a tower like Montalembert's, or the English Martello tower, as it serves not only to cover the work, but also to protect the men in retreating to the garrison.

When casemates are constructed, they ought to be at least eight feet in height, and as much in width, with loop-holes at the distance of every three feet, both to give the soldiers the command of the ground immediately under the work, and to allow the smoke to disperse. If the caponniers are of a considerable length, they ought to have traverses at short distances, or walls with loop-holes, that they may be more obstinately defended should the enemy get possession of one extremity.

Mines.

It was formerly observed, that at a very early period, mines were employed by the besieged for overturning the towers and other works of the enemy constructed near the place. After the invention of gunpowder, this mode of attack became more effectual, and of course more common. According to the modern system, a mine consists of a small subterraneous chamber or cavity, filled with gunpowder, which by its explosion destroys the works raised above or near the spot. The part containing the powder is called the *fourneau*, and the passage leading to it the *gallery*. When a work of this kind is made by the besiegers, it is properly called a mine, and a countermine when employed by the garrison. The construction, however, is the same in both cases.

When mines are to be used in the defence of a place, the galleries ought to be constructed before the siege commences, having branches running from them in various directions. The former ought to be of masonry, the latter may be constructed of timber. The works before which mines are to be cut, ought to be of sufficient strength to resist the enemy till such time as the mine be finished, if it has not been previously constructed. A mine, indeed, ought never to be used but before a strong and important work, where it is expected that the enemy will make a formidable attack. When mines are employed under an outwork for the purpose of dislodging the enemy should they get possession of it, they ought not to be too near the escarpe lest they should be discovered by the enemy's miner. In general, they ought to be at least 12 feet distant from the revetement of the work, and if possible lower than the ground of the fossé. The principal galleries should be from four to five feet wide, and from six to six and a half feet high. Three feet square will be sufficient for the branches. Several rows of mines before one another may sometimes be useful; but they ought not to be too near, lest the explosion of one should loosen the earth about the others.

Having pointed out the general disposition of the different works with regard to the trace, the next important point is to determine the relief. This is done by means of vertical sections or profiles; and hence a place is said to be well profiled when the relief is so regulated as that the different works cover each other without preventing their command of the field.

he relief f fortifications.

When a fortification is situated in a plain, all the fronts are fortified in the same manner; but if the ground be uneven, regard must be had to the different heights around as well as within the place. When the parts of a work are well arranged in this respect, the work is said to be well defiled.

With regard to the relief of a fortification, in general it may be observed, that the parapet of the most distant outwork ought to have the command of the field, and every succeeding one the command of that before it. All revetements should be completely covered,—the covered way before the demi-lune should have a command of at least six feet,—the glacis before the places of arms 7 feet six inches,—and the faces of the bastion so much as to fire over the saliant angle of the demi-lune. Some engineers have proposed to make the rampart in every case of a determined height. Vauban fixed this at 22 feet. Some have recommended 14, and others 30. From the very nature of the thing, however, it is obvious that no such rule can be applicable to all places. The great object in every fortification is to bring as many fires as possible to bear on one point, and therefore the relief must depend on the number and distance of the outworks,—the dimensions of the trace,—the distance of the enemy's parallels or trenches,—and various other circumstances. But as the commands or relative heights of the different works must always bear a certain relation to one another, these heights may be determined by the following proportions.

s for mining eight e sa- of the n.

To find the height of the saliant angle of the bastion.

As the distance between the saliant angle of the bastion and the saliant angle of the place of arms:
To the distance between the angle of the shoulder and the enemy's third parallel before the demi-lune::
So is the height of the glacis before the place of arms + 3 feet:
To the height of the crest of the parapet at the saliant angle.

The enemy's third trench or parallel is generally at such a distance as to touch the exterior side of the glacis opposite the bastions and ravelins.

ngle

To determine the height of the angle of the shoulder.

As the distance between the saliant angle of the demi-lune and the third parallel or exterior side of the glacis:
To the distance between the angle of the shoulder and the third parallel in the direction of the saliant angle of the demi-lune::
So is the height of the glacis before the saliant of the demi-lune + 2 feet:
To the height of the angle of the shoulder.

In the former proportion three feet, and in the latter two feet, are added to the height or command of the glacis, that the fire of the body of the place may not injure the men in the covered way. The same is done in every other work.

The command of the faces being determined, that of the flanks is made the same. The command of the curtain is a straight line joining the crest of the angles of the flanks. It may be observed, however, in general, that two or three feet, according to circumstances, are frequently added to the command determined by the preceding rules.

Of the gorge of the demi-lune.

To determine the command of the demi-lune at its gorge, or the extremity of its face on the counterscarpe of the great ditch.

As the distance between the saliant angle of the place of arms and the third parallel:
To the distance between the extremity of the demi-lune at its gorge, and the same parallel::
So is the command of the glacis before the place of arms + 3 feet:
To the height of the demi-lune at its gorge.

Of the saliant of the demi-lune.

To determine the command of the saliant of the demi-lune.

As the distance from the saliant of the covered way to the third parallel:
To the distance between the saliant of the demi-lune and the same parallel::
So is the command of the glacis before the saliant + three feet:
To the height of the saliant of the demi-lune.

When the command of the demi-lune is determined by this rule, that of the enceinte, as formerly mentioned, requires to have two or three feet more than the above rules give. The command of the reduit within the ravelin ought to be three feet.

The preceding methods of determining the profile of a place, will in ordinary cases give nearly the following heights: For the saliant angle of the bastion 17½ feet, and the shoulder 21 feet; for the gorge of the demi-lune about 17½ feet, and for the saliant angle 14½. The interior side, or command of the glacis, as has been already stated, is 7½ feet above the covered way, and its declivity towards the field ought to be 1 foot in 24. If the declivity be greater, it covers the enemy's trench or parallel; and if less, the covered way becomes exposed.

Revetements.

The revetement of the rampart ought to be equal in height to the crest of the glacis, and at least 25 feet above the bottom of the ditch. This gives 18 feet for the depth of the ditch below the covered way. Sometimes the revetement is not carried so high as the crest of the glacis, and the escarpe above is planted with thorns, or defended by palisadoes. This is called a *demi-revetement*; but it has the disadvantage of assisting the enemy in the escalade, and therefore ought not to be adopted unless the ditch can be inundated with water. For the same reason, the revetement should not terminate at top, as it often does, with a *berme* or round way, which serves only to afford the enemy greater facility in fixing their scaling ladders. The thickness of the wall of the revetement should be at least 4 feet at top, and 5 if the height exceed 12 feet. At bottom, the thickness ought to be one-sixth of the height. To strengthen the revetement, *counterforts* or buttresses of solid masonry, from 3 to 3½ feet thick, are built behind it, at the distance of from 10 to 15 feet between centre and centre, which support a considerable part of the pressure of the rampart. When the ditch is dry, a row of palisadoes is sometimes constructed in the bottom along the centre.

When counterguards, lunettes, fleches, &c. are used, their command is to be determined by the general rule, that every work must be three or four feet lower than that behind it. Detached crown works and horn works are to be considered as separate fortifications, and their profile constructed by the rules laid down for that of the enceinte. The profile of a place is represented in Fig. 4.

PLATE CCLVIII. Fig. 4.

To determine the relief of uneven ground.

The rules laid down above for constructing the profile of a fortification, are applicable only to level ground. When the country is uneven, it becomes a problem of considerable intricacy to determine the heights of the different works. The method now commonly practised is as follows:

A horizontal plane is supposed to pass through the highest point of the ground within the distance of 2400 feet of the intended enceinte. From this plane, which is called the *plane of comparison*, vertical lines are drawn to every remarkable point of the place to be fortified, forming as it were a chart of soundings, in which the plane of comparison represents the surface of the sea. These vertical lines, as in the case of soundings, are called *cottes*, their different lengths being marked on the plane. If these lengths differ no more than from two to three feet, the ground may be considered as level, and fortified accordingly. If the inequalities are greater than this, regard must be had to them in determining the relief.

From what has been already said, it may easily be perceived, that the crests of all the parapets, on the same front of a fortification, terminate in a plane more or less inclined to the horizon, as the different works are more or less elevated above one another. In the same manner, the surfaces of all the terre-pleins, and indeed of any other corresponding parts of the works, lie in a plain parallel to the former, and as far distant from it as these parts are lower than the parapets. Such planes, in general, are called planes of *defilement;* and that which passes through the covered way, the plane of *view* or of *site*, because it determines all the others. The plane of view ought to have such a position, that it will pass from four to six feet above the highest point within 2400 feet of the front. As three points are necessary in determining any plane, the three employed in this case are two in the line intended for the covered way, and one on the summit, or rather five to six feet above the summit of the highest ground about the place. If the line joining the two first points be horizontal, the cottes of the plane of view, or the distances of the different points in the plane of view from the plane of observation, may be found by the rules already given for determining the relief of a fortification or level ground. If that line is not horizontal, the angle of its inclination is first to be ascertained, and from that the cottes may be easily computed.

If an eminence running along a front be nearly of an equal height, the front ought to be parallel to it; but if the eminence is higher at one extremity, the front ought to be at a greater distance from the higher part than from the lower.

If a front runs across an eminence, the parts of the front at the bottom on each side are to be covered by saliant works on the top of the eminence, and the whole front may then be constructed on one plane of view. If it crosses two eminences with a valley between, it will require two planes of view, always taking care that there be saliant works on the eminences, by which the enemy may be obliged to open his trenches at a greater distance. If the place be surrounded by eminences on all sides, each front will require a plane of view for itself.

In our introductory remarks to this article, we took occasion to enumerate some of the leading advantages which a country derives from fortifications in general, and particularly from those on the frontiers. With regard to the position of the latter, it may be observed, that if the country be mountainous or woody, a few fortifications on the most commanding positions will form a sufficient cordon for opposing an invading army. This cordon ought to be either a straight line, or convex towards the enemy, as in this direction it affords greater facility to the different posts in assisting one another. If the country be level and open, it will be necessary to have two or three lines or cordons of fortified places, that the enemy may be forced to encounter at least ten or twelve sieges before he can enter the country in great strength. If a river forms the frontier line, the fortifications are to be placed at the junction of the river with other rivers—on islands, eminences, or any other advantageous position. Care should also be taken to cover the sluices that may be constructed for inundating the country, when that measure is rendered necessary. Fortifications should always be equally distributed according to their strength, so that the weaker places may not be all on one part of the frontier. But the side which chiefly demands the attention of the engineer, is the sea coast, which is always more easily penetrated, and consequently requires the assistance of every advantageous position that can possibly be obtained.

The most advantageous positions of fortresses according to the nature of the country.

Different forms of fortresses.

The *enceinte* of a fortification may be a figure of any number of sides, from a square upwards, the length of the side in each being 1100 feet. All figures, however, are by no means equally advantageous; and therefore it is of considerable importance to determine the comparative merits of each.

The square.

The square may be readily fortified, so as, by means of ravelins, counterguards, and tenailles, to be equally strong on every side. But the garrison which it is capable of containing is comparatively small; and it is scarcely possible to make it hold out more than from twelve to fifteen days. The same remarks are applicable to the pentagon, neither the one nor the other being fitted for an important position.

The pentagon.

Hexagon.

The hexagon is superior to either of the former. Its faces and flanks are sufficiently large; it will admit of other outworks besides ravelins, counterguards, and tenailles, and will contain 2400 infantry and 100 cavalry. It can only be used, however, in situations where assistance can be quickly obtained, as it cannot be made to hold out longer than from twenty-two to thirty days.

Heptagon and octagon.

The heptagon and octagon will contain a garrison of from 3000 to 3500 men; and, by the help of outworks and mines, may be rendered capable of a considerable resistance. The defence of the heptagon may extend from twenty-two to thirty-five days, and that of the octagon from thirty to forty-five.

Enneagon, &c.

The enneagon, decagon, and endecagon, are capable of containing 4000 or 5000 men; and consequently, from so large a garrison, can spare a greater force for the defence of outworks, than a polygon of fewer sides. If, with the outworks, they possess the advantage of inundation, they may be considered as places of the first order. Under these circumstances, they may hold out from forty to sixty days.

Dode- gon, &

Dodecagons and polygons of more than twelve sides are considered as the strongest of all fortifications. They contain a garrison sufficient to defend not only the places themselves, but also the passages leading to them, as well as smaller forts in the neighbourhood. If all the parts are equally well constructed, the defence may be extended from forty to ninety days.

It is also to be observed, in comparing these various figures, that the polygons of a smaller number of sides are much more expensive than those of a greater number, if the same advantage in point of strength is to be derived from them; at the same time that a much smaller army is required for besieging the former than the latter. A hexagon may be completely invested with 25,000 men—an octagon by 35,000—but a decagon, or dodecagon, will require 50,000.

Forts.

Places that require to be defended only from a *coup-de-main*, such as passes, tops of mountains, harbours, &c. will be sufficiently protected by a fort, or small fortress. Of this kind are the forts near Antwerp, Dunkirk, Brest, Toulon, Dover, and in almost all the colonies in the East and West Indies.

ntrenched amps.

Intrenched camps are works raised for the protection of an army near a fortress, by taking advantage of moors, water, &c. in the neighbourhood. Under this class of works may also be included the forts constructed about a large town to prevent a siege, as well as to cover the magazines in the place from the enemy's fire. If such works are raised about a fortress, they should be sufficiently near, and strong enough to form an intrenchment. If the fortress be on the frontiers, such works are very useful.

tadels.

Citadels are forts, or large reduits constructed within fortresses, for the purpose of commanding the town, should the inhabitants prove refractory, and to serve as a retreat to the garrison when the place surrenders. Citadels consist of an earthen rampart and a ditch, but ought always to be stronger than the fortress, that the enemy may not be tempted to attack them first. If possible, the ditch should be filled with water: if not, it must have a revêtement. The souterrains of the citadel should be large enough to contain the garrison; and the communications with the town should be such, as that they may be destroyed by mines when necessary. The space between the town and the citadel is called the *esplanade*, and is from 300 to 400 feet wide. In citadels, as well as in all other forts, martello and other towers may be used with considerable advantage.

The form of a fortress depends a good deal on the nature of the ground on which it is constructed. If the ground be quite level, the fronts may be equal in every respect, both in the trace and in the relief. If a river runs through a town, it should pass under the rampart, and be covered with a shell-proof arch. The entrance of these arches are to be shut up with iron doors on the outside; but, if the river be navigable, on the inside. The water of the river is to be used, if possible, for filling the ditches at pleasure; and for this purpose, a batterdeau is to be constructed across the river at its entrance, and along each side, so as to stop up the communication between the river and the ditch. By means of sluices in this batterdeau, the water may be thrown into the ditch, and let out by a similar batterdeau at the opposite side, when the river issues from the place. These batterdeaux ought to be six feet above the usual height of the surface of the water, but never so high as to be seen by the enemy.

of a run- gh a

If a river runs close by a place, no other work will be necessary on that side, than a single enceinte with a covered way; but if there be a gate towards the river, it will require to be covered with a strong work called a *tête-de-pont*, or head of a bridge. If a canal be carried from the river through the place, the sluices that form the communication must also be strongly fortified, and the entrance of the canal or river into the place covered with demi-lunes, lunettes, &c. It will be found most advantageous to let the river or canal issue from the place at the curtain.

Fortress on a hill.

If a fortress be situated on a hill, the rampart should be constructed so as to enfilade the declivity of the hill as much as possible, independent of the outworks. Such fortresses are generally small, but very strong. If the situation of the place be in a moor, or ground any way impassable, it is still more easily fortified, particularly if there be a command of water. A single enceinte with demi-lunes before the gates, will in general be sufficient for such a place; but if there is a more easy access on any side, it is to be covered by stronger works. These outworks ought to have the gorge enclosed by a wall with loop-holes.

In a moor or marsh.

When a fortress has a plain on one side, and a moor, height, or impassable marsh on the other, the side most open to attack should be nearly a straight line, while that towards the other may have a considerable degree of curvature. With regard to the works necessary on each side, the observations we have already made will be found useful; though, after all the directions that can be given, a great deal must in every case depend on the skill and experience of the engineer. It may be observed in general, however, that fortifications on unequal eminences, or on eminences and plains, are always disadvantageously placed; but when it is necessary to construct them on such places, the side most open to attack should have as open bastions as possible; and if such sides have eminences in front parallel to them, or nearly so, it will be necessary, in many cases, to occupy these eminences by detached forts and other strong works.

On the sea coast.

When a place is situated on the sea coast, the side next the sea may be secured against a *coup de main*, by a single enceinte, or by strong detached works. When the place is at a distance from the sea, but communicates with it by means of a long canal, forts are to be constructed along the canal at convenient distances: these are generally placed at the ends of dams or dikes, and so formed as readily to enfilade the canal or its bank. If the forts can be approached by vessels, they ought to be of masonry, and the guns mounted upon them should be 36 pounders. They ought also, in this case, to possess the means of making red hot balls.

SECT. II.

Temporary or Field Fortifications.

Such is a general sketch of the modern system of permanent fortification, or the construction of fortresses that are to be permanently used as places of strength. We shall now proceed to consider the most approved plan of field fortification, or the construction of temporary works for protecting an army, or a detachment in the field.

General use of field works.

As field works are constructed of the same materials, and intended for a time to serve the same purposes as fortresses, many of the general principles laid down above in the construction of the latter, are equally applicable to the former. The strength of each consists of an earthen mound, with a ditch before it, and the only difference, therefore, between them, is in the form, size, and number of works. The first object in field fortification is to give the work such a form as will render it most capacious at a given expence. The flanking defence should be as much as possible employed, and the flanked parts within the range of musket shot, that is

400 or 500 feet. The saliant angles are always to be strongest, and dead angles, or points, that cannot be seen from any other part of the work, as much as possible avoided. To render the faces more nearly parallel to the field, the saliant angle should be very obtuse, and its defence will be considerably improved, if, instead of forming an angular point, it be truncated, rounded, or serrated. These different forms are represented in Fig. 5. A, B, C. Saliants like C, where the faces consist of a suite of small saliant angles, are useful in removing all unflanked angles; but the sides, forming each of the small saliants, ought never to exceed two feet; when they are more than this, they either weaken the parapet, or they render it necessary to increase its thickness, which both adds to the expense, and encroaches on the room within. Perhaps, upon the whole, the best form of a saliant is the circular represented by B. With these general remarks, we shall now proceed to enumerate the principal works employed in field fortification.

Plate CCLVIII. Fig. 5.

The redan. The *redan* is a work consisting of two faces, like a demilune, sometimes also having flanks, in which case it is called a *piece*. As the redan has an open gorge, it is easily taken in rear, and is therefore never used but to cover a road, dyke, village, castle, or other work.

Redoubt. The *redoubt* is an isolated work, and of course forming a complete enceinte. It is generally triangular, square, or circular, and sometimes also a polygon. The triangular form is seldom used indeed, its angles being too acute, and the space within too small. The circular redoubt encloses a large space, but is difficult to construct, and cannot be well flanked. The square, or pentagonal form, is therefore most commonly used.

As a redoubt is liable to be attacked on every side, its size ought to be so proportioned to the number of the garrison, that it may be defended on all sides at once. To be sufficiently defended, a side will require a man to every yard; and three ranks of men. The first rank fires, the second loads, and the third acts as a body of reserve.

The number of men necessary for different kinds of works. The weak defence of such works generally arises from the bad disposition of the men who are to defend them, and therefore great care is necessary in accommodating the work to the number of the garrison. A redoubt, whose side is about 12 yards in length, will inclose 36 square yards, but will contain men enough only for one rank along the parapet, and is besides much exposed to the destructive effects of stone balls and shells. This is, therefore, the smallest redoubt that ought ever to be constructed; if the side be 14 to 16 yards, the space within will be 60 to 80 square yards, and will contain men sufficient for one rank and a reserve. A side of 18 to 20 yards will afford room for 144 men, being enough for two ranks, and, in general, the more the sides are increased in length, the greater in proportion will be the room afforded for the garrison. This is to be understood, however, only of isolated works, as those to which succours can be readily afforded, do not require to be increased at this rate. If the side of the redoubt exceed 30 yards, there will be accommodation within for 500 men, of which 384 will be sufficient for a complete defence. In this case, therefore, the redoubt may be constructed with flanks; and, if guns are to be planted upon it, it may also have outworks. The general rule for determining the fire lines of redoubts, is to allow three men to eight square yards of interior room, if the garrison exceeds 90 men; but, if less, one man to two square yards. Redoubts are of great use in preserving a communication with advanced posts, and defending a defile, height, passage of a river, a frith, or even the wings of an army; but they are also very defective in some respects. They have unflanked angles, and a dead angle all round the parapet. The first may be remedied by placing them in such a situation that their saliants cannot be assaulted.

Forts. A *fortin*, or *field fort*, resembles a redoubt, but is larger, and has a greater variety of forms. It is called a fort when isolated, and a tête when the gorge is placed upon a river, defile, &c. When forts are not irregular, which is, however, in many cases, the most advantageous form, they are either *star forts* or *bastion forts*.

Star forts. Star forts, or *forts à tenaille*, are such as form a regular suite of saliant and re-entering angles. They may be considered as polygons, whose sides are broken so as to form the re-entering angles. If possible, the saliant angles should never be less than 60 degrees, and the nearer they approach to 90 the better, as a rectangular defence is always the best. The *brisures*, or faces, forming the re-entering angle, should not be less than 50 feet, nor more than 100. If they are longer than this, they require a numerous garrison to defend them, and it would therefore be better, in such cases, to construct a small fortress, especially if guns are to be used.

Star forts are seldom constructed either in the triangular or square form, a redoubt being almost always preferable to either. In a triangle there can be no brisures, in a square their angles are 150 degrees. A pentagon is somewhat superior to both, the defence of its saliant angles being better, and the angles of the brisure 132 degrees. The hexagon is still better than the pentagon, though its saliants are by no means well defended. The heptagon has saliant angles of 128 degrees, and those of the brisures 112. This form might therefore be used with considerable advantage, were the construction not so difficult; the most convenient, however, as well as the most advantageous polygon for works of this kind, is the octagon. The construction is made either upon the interior polygon, by placing equilateral triangles on its sides, or on the exterior side, by means of the perpendiculars from the saliant and re-entering angles.

Bastion forts. Bastion forts have frequently been proposed; but in general they are inferior to star forts. The triangular half bastion is peculiarly defective. They are difficult to construct—the saliants are too acute and ill-defended—the faces of the demi-lunes are without any cover, and the interior surface is too small. The square half-bastion is little better than the triangular, but it incloses a larger space. When the bastions are full, the work may sometimes be very advantageous, and the construction is the same as in permanent fortification.

In bastion forts the sides should not be less than 100, nor more than 200 yards, that the flanked parts may be within musket shot. Perhaps 120 yards is a good medium. The best form of the curtain is to break it twice, by which a very advantageous fire is obtained.

The principal things to be considered in field fortification are the nature of the ground, and the soil to be used, the attack that is likely to be made, the relative importance of the place, and the number of the garrison.

When the place is to be defended against small arms only, the talus may be as steep as possible, from the summit of the parapet to the bottom of the ditch; the base being equal to the height. If guns are to be used, the slope should be greater, to make a better defence. The base, in this case, may be one-third of the height.

if the earth is heavy; one-half if lighter; and two-thirds, if it be sandy or stony. To keep the talus from falling down, gazons are used wherever they can be conveniently obtained. Revetements of various other kinds have also been used, as fascines, saucissons, hurdles, trees, boards, &c. but no method of constructing the talus appears so easy or so advantageous as that already described, especially if it has a row of trees on the front, standing seven or eight feet above the ground. Sometimes it may be useful to interrupt the talus by a berme, so as to take the pressure of the parapet as much as possible off the counterscarp. Care must be taken, however, that this berme be at least 5 feet 6 inches below the exterior summit of the parapet, lest the besieger take advantage of it to fire over upon the garrison. Palisadoes and chevaux de-frises, or beams stuck full of pins, &c. are useful on the berme, only when it is covered from the enemy's fire. The interior slope of the parapet must be as little as possible, that the soldiers may approach close to it. From 10 to 16 inches of a base will be enough, and it ought to be lined with fascines, boards, or gazons.

Banquette. The banquette behind the parapet, in a single work, should be from two feet to two feet six inches broad; but if the work has a curtain resistance, it ought to be 4 feet in breadth, to afford a ready communication. It should also be from 4 feet to 4 feet 3 inches lower than the parapet, and have a slope or stairs of fascines towards the interior by which it may be ascended.

All these works, when they are intended for a short resistance, consist only of a parapet; but when they are larger, and intended to hold out for a considerable time, they have generally a small rampart, for the convenience of the artillery.

onge. The upper slope or plonge of the parapet ought to be directed to the upper part of the counterscarpe; or if it has a great command of the surrounding country, it may be directed somewhat higher, as the slope should never be more than from two to three inches in the foot, lest the upper part of the parapet should be too much weakened. This is, indeed, double of what is allowed in permanent fortification. If the plonge cannot be directed to the crest of the counterscarpe, it will be proper to construct a glacis, having the same slope as the plonge of the parapet. It is to be particularly observed, however, that if a place can be cannonaded by the enemy, the slope is to be reduced as much as possible.

ckness e pa- t. The thickness of a parapet depends on the purpose for which it is intended, and the ordnance that may be brought against it. If it is only a temporary place of security, till reinforcements come up, two to four feet in thickness will be sufficient, as it will, in all probability, be attacked by small arms alone. But if great guns are likely to be employed by the enemy, or if the work is to continue for any considerable time, the parapet ought to be at least 10 feet. A four pounder ball enters about 4 feet, an eight pounder 6 feet, and a twelve pounder about 8 feet in common earth, such as is generally used in constructing fortifications. If therefore a heavy cannonade be expected, the parapet will require to be 12 feet, or perhaps in some cases more.

The fossé before the parapet, in field fortification, is generally not very deep, but ought never to be less than 6 feet, and always 12 if possible. The talus of the fossé may be steeper than that of the parapet, as the earth of the former possesses its natural adhesion. Of course the base of such slopes is very small compared to their height.

Traverses. If a work is situated on ground where it is liable to be enfiladed, it must have traverses in the interior. The thickness of these traverses depends on the attack which they may have to sustain. If this consist of small arms only, two feet will be sufficient; but they will require 6 to 9 feet, and, in some cases, 10 to 11 feet, to hold out against field pieces. The talus must be as steep as possible, that they may occupy little room, and to preserve the communication they ought to have passages through them. In every work, indeed, there should be openings from 4 to 5 feet, or from 8 to 9, according to the size of the work, to keep up a free passage between the different parts. The talus of these entrances must be as steep as possible, and they are to be shut up with chevaux de-frises, large branches, and other barricades. They ought also to be covered by a traverse behind them, 6 feet longer than their width, and from 3 to 9 feet in thickness. This traverse has a banquette, from which the soldiers can fire on the enemy, in approaching it. Before these entrances, it is usual to construct a bridge, consisting of boards laid on scaffolds in such a manner as to be readily removed or destroyed when necessary. This bridge is about 3 feet wide in small works, and 9 to 10 in works whose guns are mounted. The gorge of a work is always to be inclosed, at least by palisadoes, to prevent a surprise.

Corps de garde. If a work is to be occupied for any considerable length of time, it should be furnished with a *corps de garde*. In small works this may consist of huts covered with branches; but in larger places it should be of timber, and have if possible a shell proof covering. The exterior parts of a fortification may be increased and strengthened either by active or passive works of defence. A covered way, however, is in general of little use in field fortification. It is very expensive, it adds 3 to 4 feet to the height of the profile, weakens the rest of the parapet, requires a deeper ditch, and can be defended only by a large garrison, which, however, generally retires before the assault is made, and creates confusion within the place. When the work is pretty large, a covered way may be used, and then the crest of its parapet ought to be 4 feet above the horizon; and if it be dug out behind the glacis, the latter will require a banquette. The width of such a covered way is nine feet. Traverses are seldom used in the re-entering angles of the covered way in field works. If they are used it is to cover an entrance, and are constructed in the same way as places of arms in permanent fortification. Such traverses, however, require a great command. The parapet must be at least 11 to 12 feet. A simple glacis therefore, is perhaps better, except in very large works. A second glacis, without any covered way, is of great use in field works. Where it is used, the parapet will require only from 8 to 9 feet of command, and the obstructions that may be laid in the enemy's way, are better concealed. Such a glacis is also of great advantage where small works, as fleches, are used, and may be successfully employed in producing little inundations, particularly if ditches are made in it at short intervals that cannot easily be passed. It is always of the greatest importance, indeed, to have the fossé full of water.

Trappes de loups. Of the various obstructions used to retard the enemy, *trappes de loups* may be mentioned. These are square or circular pits, six feet in depth, and as much in diameter, with a pole in their centre, to prevent their being a cover to the enemy. The earth dug out is heaped up among them, or dispersed around. Trappes de loups should always be hid by a glacis, and should be arranged in three rows in echiquier, like the black squares in a chess-board.

Palisadoes, &c.

Palisadoes are obstructions that may be used at all times, but their advantage depends principally on the manner in which they are employed. They are constructed in different parts of the fossé, and placed in various positions, according to the expected attack, and the kind of defence which the ditch possesses. Care must be taken, however, to place them without reach of the enemy's large guns. If trappes de loups are before the fossé, the palisades ought to be behind it.

Another method of strengthening a place, or rather of obstructing the enemy, is to plant large branches of trees on the counterscarpe, on the berme, or behind the glacis. The last is perhaps the best position, as they are defended from the enemy's fire. Chevaux de frises may be substituted for branches, but they are more difficult to be procured.

Besides these, various other obstructions may be employed to prevent or retard the enemy's approach; as stakes driven into the ground for a considerable space together, *herses* fixed in an inclined position, *caltrops*, &c. These, of course, are to be adopted or not, as circumstances may require. In some cases they may be of little use.

Fougasses.

In field fortification, *fougasses*, or small mines, are frequently of great advantage, provided they be carefully attended to, and fired at the proper moment. The fourneaux of these mines are laid twenty or thirty paces before the counterscarpe, and the *saucisson*, or long thin bag of powder for firing them, is conveyed by means of an *auget*, or wooden trunk. Mines can only be useful when the powder can be kept dry for some time. Large mines for outworks are too expensive, and of less use than smaller ones. The best position for them is before the saliant, as there the attack is more likely to be made.

Defence of the fossé.

The fossé of a fleche is defended at its gorge by caponniers, or by palisadoes three to four inches thick, having, at the distance of every 2½ feet, an opening like a loop hole, or a low palisade, which answers the same purpose. The entrance to the work may be concealed from the enemy by the palisade, on one side projecting before that on the other. Such a defence, however, can only be used where a work cannot be attacked in its gorge. A stronger defence of the same kind, for the gorge of a fossé, is by means of two rows of palisades, fastened at top by cross rafters, on which are placed fascines, and the whole covered with earth. Montalembert has proposed to construct these with a saliant angle, and, that they may be less exposed, to place the loop holes about two feet above the bottom of the fossé, but lower than the glacis. Such caponniers have a subterraneous communication with the interior, by a passage lined with poles and boards, and are surrounded by an *abattis*, or by trappes de loups, to prevent the enemy from approaching them. Similar caponniers are placed in the saliant angle of the counterscarpe, ten feet distant from the ditch, which is there enlarged to twelve feet in width towards the field, and lined with poles, boards, &c. The loop holes of these caponniers are formed so as to enflank the glacis, and the gorge towards the ditch is shut by strong palisades. They are also surrounded, like the others, with trappes de loups, or an abattis. It may be observed of all these caponniers, however, that they cannot be made to hold out long against a cannonade, and are therefore useful only when that is not to be expected.

Reduits.

In large forts, it is sometimes of advantage to have a reduit to which the garrison may retire, and which, of course, may be large enough to contain them, till such time as assistance, or favourable terms of capitulation, can be procured, in case the fort should be taken. If the reduit is constructed of earth, it will require no greater profile, than merely to command the work before it. If it be made of timber, it is to have loop-holes, by which the soldiers may fire on the enemy, without being exposed to his fire; and it should be so constructed as to inflank every part of the fort. The cover must, if possible, be shell-proof.

Muller's caponniers.

Similar to this is the work proposed by C. Muller, consisting of a redoubt, with four small bastions at its saliant angles, the diagonals forming a sort of caponniers of wood-work. In the middle, where these caponniers meet, this wood-work has two stories, with loopholes in the walls. All such works, however, being of wood, are easily destroyed.

Block-houses.

The most advantageous kind of reduits are *blockhouses*. These have walls formed of rafters, from one to three feet thick; and roofs, consisting of two layers of the same, overlaid with fascines, and covered with earth, so as to be shell-proof. Such houses may even supply the place of a fort, and are particularly useful in winter. The access is by a ladder to the top, or by a side door, which is sufficiently defended by palisades, and also by abattis or trappes de loups around it.

Traverses are useful in the interior defence of a work, if they are so constructed and distributed as not be exposed to an attack behind, nor liable to be enfiladed by the enemy.

Defence by cannon firing en barbette.

A work may be defended either by cannon or small arms. The advantageous use of the former depends on the tracing of the work, and the number to be employed. It is to be observed, however, that the guns are always to be placed so as to enfilade all the avenues to the place, and enflank the works before them. The best situation for cannon appears to be the flanks and the saliant angles; and that they may the more readily be brought to bear on the enemy, in whatever way he approaches, they should be fired there *en barbette;* that is, over the parapet, without the assistance of embrasures.

Sometimes, however, guns will be more advantageously placed behind the embrasures, viz. to defend a defile, or any narrow passage; and in this case it is proper to cover the artillerymen, in order to protect them from the enemy's tirailleurs, who always approach very near to the work, being covered by the ground, and thus make great havock before they come within reach of the fire of the small arms. The artillerymen who serve guns mounted *en barbette* in saliant angles, are very much exposed to danger; for here a cannon can only fire a single shot, while the enemy's tirailleurs can molest it from all sides; and, therefore, artillery alone will not always prevent the enemy from taking a work. Artillery should therefore never be placed in works where the enemy can approach with ease, as in such cases it will have little or no effect. From this it will be evident, that wherever cannon are employed, it will be necessary that they should not be too much exposed, as they can only be efficacious in such places as present great difficulty to the enemy in his approach.

Defen
small a

The fire of small arms should defend and enfilade every part before a work, and be directed in such a manner, that the enemy may every-where be received with the best effect; and care must also be taken that it assist the fire of the great guns. The flanks are also the most proper places for the small arms; but it being necessary likewise to defend each part of the parapet, and to receive the enemy with a front fire, it will be requisite to give the small arms a place all round a parapet, but particularly to place the most numerous party of them at the flanks. To increase the defence of the saliant angles, the serrated form of the faces is the most advantageous; but the faces of the small saliants should never be larger than for two men, or at most for three, one of which is to be placed in its saliant angle.

lelief.

The relief which, in permanent fortification, is the most difficult to determine, depends, in field fortification, upon particular rules. In general, the height of the work differs according to its size and situation, and often depends wholly upon the opinion of the engineer; but there is a minimum of height, below which it never should be: That minimum is 4 feet 6 inches; and even this only for such works as merely serve to cover men from the fire of small arms for a short time; as, for instance, an outpost. No parapet should, however, if possible, be less than six feet high, if intended in any degree to command the field round it; and to cover the men completely to any distance behind, it will require to be 7 feet 6 inches. At this height, however, the soldier sees his enemy under a smaller angle, which renders his fire more nearly vertical; a parapet, therefore, should never, if possible, be higher. If the height be from nine to twelve feet, this defect increases considerably; and if flanks are constructed, they have a large dead angle before them, both of which are always, if possible, to be avoided. But, on the other hand, a height of twelve feet secures the interior part of a work completely from the enemy's fire, and has, in this respect, great advantages. A strict attention therefore to circumstances, added to a sound jugdment, must determine the most advantageous relief for any work.

mand
e co-
l way.

The covered-way of a field fortification should have a command of at least 4 feet 6 inches above the ground; and the terre plein should be two feet below the latter, or 6 feet 6 inches below the crest of the covered way. This command may be increased to six feet, and even to 7 feet 6 inches, if it is to be made very large. The parapet should always have five to six feet command over the covert-way, and the crest of its glacis; therefore, such covert-ways will not be of any use where the parapet cannot be at least 10 feet high. A simple glacis round a field-work should never have less than six feet command below the parapet, that the enemy may not fire from its crest with the same advantages into the work, as its garrison can at him. If, however, there are places of arms in its re-entering angles, then it is to have the same command as a covered-way, and also the parapet as much above it.

a-
acis.

An avant-glacis is to have at least five feet less command than the covered way, but must always be made so high as to cover the objects behind it. If it is situated only before a simple glacis, the parapet behind it should have at least six feet command over it.

The plonge or slope of the upper part of the parapet, should be in the same plane with the glacis, the covered way, or the avant glacis. At all events, this plane should never pass at a greater height above the crest of the glacis than two feet. The same is to be observed if the earth for an advanced glacis is dug out behind it; and in this case, no part of the ground behind the advanced glacis should be more than two feet below a plane passing through the crests of the covered way and the parapet. The command of outworks is also the same as of the glacis of the covered way, if not more than 200 yards distant from the principal work. If, however, the principal work has a covered way, this is to have a command of five feet above it; and consequently the parapet must have from eleven to twelve feet command above the field. Should the principal work be an outwork, then that which covers it must have a command of at least twelve feet above the covered way and its glacis before it. The command of field fortifications varies therefore considerably from that of permanent fortification; it being in the former from five to six, and in the latter only two to four feet. The reason of this is, that the enemy can attack the latter without being covered, but he can only approach the former while covered by a parapet, which forces him always to be at least seven feet lower than the crest of the work he attacks. The method laid down for works in permanent fortification, to determine their relief, being too artificial, and requiring too much time, is not applicable in field fortifications, and here, therefore, a more simple method is requisite for determining this relief. But it will frequently be found impossible to give such a relief as may have been determined upon, and in this case a more advantageous one is to be chosen, and preferred to a great command. By this means, field works can be made much stronger than by a defilement artificially chosen, as in permanent fortification, and which is perhaps still more difficult to be executed than that given by the above rules.

Difference between the command of field and of permanent fortifications.

Works near an eminence.

Works which are open in the gorge, or which cannot be attacked from behind, must be at least 300 yards distant from any eminence which commands it, if only small arms are to be feared; but if cannon are employed, it will be necessary that the distance should be at least 900 yards.

Defilement of such works.—Against small arms.

The defilement of a work, which is open in its gorge, if it be necessary to place it nearer to a mountain than 300 yards, is determined as follows:—Poles four feet six inches in length are erected on the highest visible summits of the mountain. The points which it is required to cover by the intended work, are then marked, and poles erected at them of such a height as that their tops shall just be within the command of the parapet. These poles being united at top by a cord, the saliant and re-entering angles of the work are determined, and poles erected at each, of such a length that their tops shall be in a line with the cord and the poles on the mountain. The height of these last poles will give the height of a work necessary to have a given command over a given place near an eminence. After determining the defilement of the parapet in this manner, the tops of the poles along the line of fire of the parapet are united by a cord, and wherever the line of this cord is below the plane of defilement, it is elevated by means of poles.

Against artillery.

In the same manner the defilement for works to resist artillery is determined, if the heights are not above 900 yards distant from it. This will always be most difficult where the visible heights are situated on one side of the fortifications. In this case, after fixing the plane of defilement of the parapet, it will still be necessary to determine a traverse, and its plane of defilement, that the face may not be taken in rear or in flank by the eminence near it. The most convenient situation for such a traverse being chosen, the plane of defilement is to be determined in a manner similar to that described above, so as to cover every part of the works at such a height as may be necessary. The traverses are at the same time to be so chosen as always to keep up a free communication, it being necessary that no part of the defence of the works be obstructed. The traverse is always to be determined at first, where two planes of defilement are necessary; but, where all the works can be laid down according to one plane of defilement, the parapets are determined, and then, at proper distances from them, the place for the traverse is chosen, and afterwards constructed from this point to the saliant angle of the work.

A work may have only one re-entering or saliant angle, or it may have several such; the plane of defilement, however, remains always the same, as described above; but care is, in this case, to be taken not to injure the flanking defence too much, and also not to make the dead angles too large. Several planes of defilement will, in this case, frequently be necessary. Inclosed works commonly require an enormous height to cover the men in them; and as this can seldom be allowed in field fortifications, traverses are generally preferred for this purpose.

Position of traverses.

In this case, the position of the traverses is directed in such a manner as to take up the smallest room, and at the same time to cover the greatest space. The nearer the traverse is towards the commanding height, the more space it covers, and the smaller the relief may be, but the traverses are the higher. Their defilement is made out in a similar manner to that above described; but care is to be taken in placing them so as not to block up the communication. The only case where the traverses will not be wanting, is when the ground on which the work is constructed slopes, and when by this its interior is covered. The traverses should always be as nearly parallel to the heights as possible; and therefore, if a work is commanded from several heights, the traverses will cross each other.

Works surrounded by eminences.

The most difficult case is, when a work is situated in a tunnel, or every where surrounded with commanding heights. In this case a block-house, or a corps de garde, is to be constructed in the middle of the work, which is secured from balls, and which, at the same time, serves as a traverse for the men who defend the work, or to secure its interior parts.

Intrenched lines.

Lines or works connected with each other, and forming intrenchments, should always be strong enough to resist guns; and therefore, if they are not above 900 paces distant from the height, their defilement is to be arranged accordingly. If such heights, therefore, occur, they are either to be occupied, or the position is to be somewhat altered, which is in general easily done, as the engineer will not be so much restricted on any given place as in permanent fortifications. However, in all cases where heights occur, and where the lines always remain commanded, advanced works on these heights are of the greatest use.

Works in a valley.

Should a valley between two heights require to be fortified, strong advanced works will be advantageous. If, however, the valley is very narrow, the line may have very saliant parts on the heights, and be frequently broken; but if these lines do not cover the places behind them sufficiently, then traverses must be chosen, and constructed at such places as may be deemed necessary.

The next important point to be considered, is the application of the works to the field. Small works and single posts may be established by officers of infantry, but large and composed works only are to be directed by engineers.

Different cases requiring fortifications.

An army may be in want of fortifications in different cases, viz. if it has to cover a large part of a country; if it has to act at another place, while a part of the frontier is to be well covered; if an army goes to a distance from its frontiers in an open country; if it fears an attack from a superior enemy; if it is inclined to make its retreat in sight of a superior enemy; and if an army besieges a fortress.

Frontier lines and forts.

To cover a frontier, every obstacle that can be procured, as well as every thing that tends to strengthen a line, ought to be employed. The use of fortified lines has by some been recommended, by others it has been considered as unnecessary. The former, however, appear to be right, in as far as the lines serve to protect and to inclose a country.

Such lines as serve to protect a frontier, extend from two parts, where the enemy cannot pass, or where the line can be apprised, and for their better support, they generally have fortresses along them at certain intervals. Towns, rivers, rivulets, habitations, and all other impediments to obstruct the enemy's advancing, should in such cases be made use of.

To protect whole parts of a frontier, fortified places, or rather fortresses, are the most effectual; but where there are none, large towns, and other places commanding the roads, the rivers, and the vallies, by which an enemy may approach, should be fortified in such a manner as may enable them to sustain a slight attack, and to obstruct the enemy's advancing for a few days. In this respect, strong places, consisting of fortified and frontier posts, are of the greatest advantage, if properly chosen and well constructed. They are generally surrounded with strong works, which defend each other, and also all the avenues or passages and roads, as well as the ground leading towards them. In this respect, inundations, abattis, crenelled walls, houses fitted up like block-houses, and all other possible means of defence, should be used. Sometimes houses must be pulled down, and outworks constructed, if by these means a town can be rendered stronger and less open to attack.

Intrenched camps.

Intrenched camps near the frontiers differ very much from permanent camps and frontier posts, having no habitations for the troops in them, and being only intended to serve for a short time. They generally consist of works constructed like field fortifications; but, that they may be tenable as long as possible, they ought to be situated behind such places or parts of the ground as do not allow the enemy to approach.

Têtes-de-ponts.

Têtes-de-ponts, or bridge-heads, are smaller or larger fortifications, raised before a bridge in order to cover it. Small *têtes-de-ponts* consist only of a single redan, as ABC, Fig. 6, the sides of which are favourably flanked by two traverses D and E. Such *têtes-de-ponts* are always to be constructed there, that the enemy may not attack them; that the bridge which they cover may not be destroyed by him; and that, while attacking, he may be taken in flank. These works frequently require a considerable space, either to contain divisions of an army retreating by them, or to cover a large space of the river or its banks. Large *têtes-de-ponts* are represented in Fig. 7. and still larger in Fig. 8. *Têtes-de-ponts* must always be well enflanked towards the enemy by the other parts of the works, and ought also to have a proper flanking fire of their own. The entrances to them should not be too small, to retard the movements of the troops; but they should be well defended, so as to deter the enemy from approaching them.

Plate CCLVIII. Fig. 6.

Fig. 7.

Fig. 8.

An army which is weaker than that of its enemy, must sometimes either maintain its position, or secure its movements by the aid of fortifications; and, in this case, whole lines, or connecting works, are to be constructed, in which advantage is always to be taken of the natural impediments offered by the ground, so as to strengthen these works as much as circumstances will permit.

Advantages of frontier res.

For the intrenchments of armies at present, unconnected lines or fortifications are always preferred; but those which are connected, and which form whole lines, are also of use, where any place is to be covered by a connected line; and, in this case, it is more advantageous than separated works. The latter possess these advantages, however, that they allow the troops free movements; they do not require so many men for their defence; they cover the most essential points, and are constructed at less expence. Besides this, two lines, or even three, may be formed of them, and then they allow a stronger defence than connected lines. The figure to be adopted in constructing lines, is that which admits most readily the use of all kinds of fire-arms. Different engineers have proposed different figures; but what appears to us the most advantageous, is that represented in Fig. 9.

LATE CLVIII. g. 9.

detached rks.

Detached works possess in many cases, as we have already said, great advantages over connected lines, and are in modern times generally preferred. Where a part of a country, however, has been completely inclosed by connected lines, they are, besides having a good profile, made as strong by the impediments of the ground as circumstances will permit. Of detached works, three lines of redoubts are the most advantageous, as they are inclosed, and may be placed in such a manner that they defend each other as strongly as if they had flanks. Each of these redoubts is by itself a strong work; but, when supported by the four neighbouring ones, it can never be taken but by attacking all the others. In such redoubts there should always be a considerable number of cavalry ready to attack the enemy whenever they are thrown into the least confusion.

loubts.

hes.

Flèches applied to this purpose can be taken in rear, if they are not shut; and, even in this case, their garrisons are more exposed, and the enemy may always attack them from behind. It is the same with bastions, though these certainly have a stronger and better defence than flèches, and consequently are preferable. However, their gorges should always be shut, that they may not be taken in rear. The spaces among the detached works are, if possible, made impracticable, and only a few large passages are left open, through which the troops may with ease advance upon the enemy. The first line of such detached works is always to be the strongest, though the great guns should be placed in the second and third lines, that the enemy, after taking the first, may not get the advantage of them in attacking the other lines.

Should detached works be used in a mountainous country, they ought always to occupy the most commanding points; but, at the same time, they should be so situated as to command such as lie before them, and enfilade the slope of the mountain.

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Should it happen that a small post is to be defended against an attack of the enemy, it is to be prepared, and, if possible, strengthened by fortifying it. A single house, when it has no stone walls, may be fortified in the following manner: The walls may be strengthened by boards in the inside, or by rafters applied as in blockhouses, or, if these are wanting, by making a ditch round it, and using the earth to strengthen the wall. The doors and windows are fortified with boards, and barricaded. Loop-holes are every where made, but in such a direction that the enemy cannot reach them with his firelocks, so as to fire into the inside of the house. If there is no ditch round it, other impediments are to be made use of, to hinder the enemy from approaching close to the wall. The roof is broken down, and all combustible matter covered with earth and rubbish, to defend the house from an attack from above, which might otherwise be executed by ladders.

In a stone house, the walls will generally be strong enough, or, if not, they are to be prepared as above. The same is also to be observed respecting the windows and the roof; and, if possible, it is to be made shell proof from above. The doors are either barricaded, or defended by a tambour constructed before them, to have a flanking fire.

Of a church-yard, &c.

A church-yard, a farm, or an estate, is fortified in a similar manner; but, if surrounded by a wall, either loop-holes are made through it, or, if too high, a kind of scaffolds, called *echafaudages*, are to be erected, serving for the soldiers to stand upon while firing. The church, or the building on an estate, are then generally used as a *corps de garde*, and made shell proof, by breaking down the roof and the uppermost story, and using it to cover the building. The doors, and particularly the corners of the walls round such a place, are generally covered by tambours; but, if time permits, caponniers, and other impediments to the advancing of the enemy, are made use of. The street, and roads leading towards them, are generally made impracticable by old or broken carts, harrows, boards with nails, wheels, &c. All the houses in the neighbourhood, which may be advantageous for the enemy, or which may favour or cover his approach, are levelled, and the rubbish of them used to strengthen the walls. The trees, near such a place, if large, are hewed down or sawed off, that even not a single rifleman may approach covered by any of these parts.

Of a small town.

A small, or country town, if surrounded by a wall, is fortified in a similar manner; but echafaudages are generally used behind its walls, and, if possible, two rows of soldiers are employed, one firing through loop-holes, and the other over the walls.

Guns are placed wherever their fire is of the best effect. The gates are barricaded, and covered by impediments which hinder the enemy from advancing there to attack them; besides this, they are covered by traverses, and a flanking fire is established before them, if possible. Only such parts of the gates as are essentially necessary to be open for the communication are not barricaded, but strongly defended. Every thing is to be done that may render the interior communication better and more easy, by means of sufficient passages; but, on the contrary, every means is to be used for obstructing the enemy's advance.

Part II. ON THE ATTACK AND DEFENCE OF FORTIFIED PLACES.

Attack and Defence of Permanent Fortifications.

We come now to the Second Part of Fortification, viz. the attack and defence of fortified places, and shall consider this part of our subject, like the former, under two heads, Permanent and Field Fortifications.

SECT. I.

Attack and Defence of Fortresses.

Different methods of attacking a fortress.

In former times, there were six different methods of attacking and defending a fortress, viz. 1*st*, By artifice. 2*d*, By a surprise, executed either by a secret understanding between the parties, the stupidity of the garrison, or by masked soldiers. 3*d*, By force; as the escalade, the attack demblée, or the attack d'enfulte. 4*th*, By inclosing the fortress all round with soldiers, in order to take it by a greater force. 5*th*, By famine; and 6*th*, By the attack in form, or a regular attack. In modern times, however, a place is generally attacked by the following methods: 1*st*, By surprise; 2*d*, By an open attack or escalade; 3*d*, By starving it out; and, 4*th*, The regular attack, or strong bombardment. Of these different methods, circumstances must determine which is to be preferred in any given case. Sometimes, however, a fortress may be attacked in one way, which it will be found necessary afterwards to change; and, therefore, it is not always known by what kind of attack a fortress will surrender the soonest. There are numerous instances on record of a place holding out a long time against one method of attack, and surrendering as soon as that method was changed. The surprise of a fortress ought never to be undertaken till the besiegers have gained a considerable acquaintance with the works of the garrison, and even a knowledge of the inhabitants. This may be procured by spies, deserters, or some other source of secret information. The particulars that are peculiarly necessary to be known, in order to render a surprise successful, are the depth and breadth of the fossés, the revetements of the ramparts, talents and disposition of the commander, the degree of confidence which the garrison reposes in him,—how the fortress is watched—where it is neglected, and the general disposition of the garrison.

By surprise.

The most advantageous period for surprising a fortress is in winter, during the long nights; and the best time of the night for effecting it is from two to three hours before daylight. The order for such a surprise is to be given, and the preparations are to be made, as secretly as possible, to prevent the enemy from obtaining any knowledge of it. The march of the troops to execute a surprise ought to be secret, that it may not raise any suspicion; and it must be so calculated, that they may reach their respective places at the proper moment. In proportion to the dispatch and secrecy with which such a march is executed, will be the probability that such surprise will not be discovered; and therefore a sufficient number of people to serve as guides should be ready, that nothing may be wanted, nor any detachment retarded in its operations from unforeseen accidents.

If a secret understanding with any of the garrison or the inhabitants can be procured, it will always be very advantageous; but still it is far superior to gain a secret entrance into the place. It is impossible to lay down general rules for this part of the subject; nor is it necessary, as accident, and the circumstances of the moment, will instantly point out to the experienced commander the most proper mode. It may probably happen, that one part of the town is not well watched; and in this case soldiers may enter there, attack the guard of a gate, and open it for a small party, that has been previously brought close to it. When this party enters, it is to be followed directly by a larger force. Another method of penetrating a town is by approaching secretly to the gate, and opening it by a petard; but this is hardly possible in our times, fortresses being generally so well watched, that it is impossible to approach their gates without being discovered.

Attack and Defence of Permanent Fortifications.

The gate of a town may sometimes be entered by masked soldiers, or soldiers who are habited in regimentals like those of the enemy, and who, under some pretence or other, attempt to be let in by night. A similar *ruse de guerre* might be practised, if the gates were opened too early in the morning. Masked soldiers might also enter a fortress as farmers; and as soon as a sufficient number of them have penetrated, they might attack the guard, and keep one gate in their possession until reinforcements arrive. Soldiers, under the pretence of being deserters, may also sometimes get possession of a gate. A secret understanding with some person in the fortress may essentially contribute to its surrender; and also the sending into the place, unknown to the besieged, a small party of soldiers, who, at an appointed time, are to let in a larger force. Perhaps an officer of the garrison may favour an attack, and thus a strong detachment will easily become master of a gate.

The soldiers who, after the surprise has succeeded, are to be employed in conquering the town, must have already received their orders where to march, and what service they have to perform. Detachments are to be sent directly to occupy all guards and guard-houses, as also all the places of rendezvous, the caserns, the magazines, and all the gates in particular, so as not to allow the enemy to collect any where, or to approach such places. The commandant and all the chief officers are to be made prisoners as soon as possible, and every thing done that can contribute to create confusion among the enemy.

On the instant that a surprise has succeeded, all the guards are taken by the assailants, and all such parts of the works as have been destroyed, or want repair, are immediately to be put into a state of defence. If, however, a surprise does not succeed, then the retreat is to be ordered, and to be executed with as much regularity as possible; and even in case of success, no soldier is to be allowed to quit his rank and file until all the fortress is completely in their power.

By op
tack.

The open attack of a fortress, or the attack by an escalade, is, in some respect, similar to a surprise, and an intended surprise is often changed to an open attack. An open attack can only be executed if the fossé of a fortress is easily passed, or if the water in it is not deeper than from four to five feet; if the revetements are not more than twelve feet above the bottom of the fossé, and if the garrison is not always on the alert, so as to direct the fire of guns mounted on the flanks against the assailants. Should there be no revetement or stone to obstruct an escalade, other impediments may easily be cut off. Thorns, however, and bushes, are difficult to remove, and require a considerable time, if they are planted very thick. Ladders used to effect the escalade are to be constructed for the purpose, and should always be of such a length as may be necessary to mount to the top of the revêtement. If it be found requisite to use very long ladders, two or more short ones, joined together, will answer the purpose, and will also be more easily taken from one place to another.

Various opinions have been entertained with regard to the best construction of these ladders; but, after all, a simple ladder of wood appears to be the most convenient, as being the lightest. The number of the ladders depends upon circumstances; one for every five men appears to be a very fair proportion.

In attempting an escalade, it will always be of the greatest advantage, if the garrison can be taken by surprise, and therefore all preparations are to be made in the most secret manner. The same secrecy is also to be observed with respect to the movements of the troops, and in carrying the escalade itself into effect. When all the necessary preparations have been made, and the attack is to be undertaken, the troops assemble, and march secretly to the covered way. Having penetrated this, removed the other obstructions, and passed the fossé, the ladders are all to be applied at the same moment. A number of men then mount by them, sufficient to make prisoners of the guard, at one of the gates, which is immediately opened to a reinforcement previously posted near it. This is followed by a larger force, the other gates are thrown open, and the town taken possession of in a similar manner as by a surprise, described above.

If a fossé cannot be passed otherwise than by small boats, with ladders called *sambukes*, it will be almost impossible to effect an escalade. The garrison ought never to know the real point which it is intended to attack, and therefore false attacks are frequently of great use, as are also several attacks at the same time. But it is equally necessary that all this should be done with as much silence as secrecy; for the least noise may discover the whole operations to the garrison, and perhaps frustrate all the attempts.

amine.

The most certain method of forcing a fortress to surrender is by *famine*; but it is at the same time the most tedious, especially if the place is well supplied with provisions, and if it is situated near a river. The taking of a fortress in this way, indeed, is not always practicable, though in certain cases it may be successfully adopted, as when a fortress has a very large garrison, when the inhabitants are very populous, or when it cannot be taken by any other means.

When it is determined to take a fortress by famine, it is blockaded by placing troops round it at such a distance, as to be without the reach of its guns. The roads, and all passes and passages towards the town, are occupied. The cavalry is stationed on the plains, and the infantry on the inclosed ground. Each of these has its advanced posts towards the enemy, in order to prevent any communication between the fortress and its allies. That no person may pass the posts during the night, constant patroles are sent round; and the greatest vigilance is always observed, where any attempts at communication are suspected. The blockade of a fortress is still more perfect, when it is surrounded by a contravallation composing a connected line, or, what is still better, by a cordon of redoubts.

A town inclosed by impracticable ground, and which communicates with the field only by some roads or SCAPES, may be more easily, as well as more effectually, blockaded, even by a small corps, than a fortress situated in an open country can be by a large army.

A town partly surrounded with water cannot be blockaded, unless the blockading troops command the water, whether it be the sea, a river, or a lake. In this case, a flotilla, and frequently a fleet, will be necessary to blockade the place from the water side.

To assist the means of consuming the enemy's provisions as soon as possible, a bombardment is frequently of the greatest use, as the enemy's magazines and storehouses may thereby be set on fire, and the inhabitants exposed to much danger. The habitations of the garrison will also be rendered unsafe, and the soldiers exposed to constant disturbance and fatigue.

A bombardment is most advantageously made by mortars of a large calibre, and at great distances, with shells of 12 inches diameter, and large guns, with red-hot balls. The shells used on these occasions should be filled with combustible matter, so as to set on fire the objects near which they explode. For the same purpose, fire-rockets may also be used with advantage. Whatever, indeed, threatens to consume the place, must operate as an inducement to the garrison to surrender, particularly if their provision be destroyed. This may sometimes be effected by spies, or some other secret means, which of course decides the fate of the place. It ought always to be remembered, however, that the siege is carried on, not as against an inhabited town, but a military post, and therefore the inhabitants are to be spared as much as possible. At the same time, it must be acknowledged, that this is more the business of the besieged than of the besiegers.

By the attack in form.

The attack in form, or the regular attack of a fortress, begins, as in the last case, with investing, or inclosing it with troops. This investment is particularly necessary to cut off the communication between a fortress and its army. Some towns, however, cannot be invested completely, as, for instance, when a fortress is situated on the sea, and possesses a greater naval force than the besiegers. In this case, such a place can always receive sufficient reinforcements, and this alone will very much retard the siege. Those fortresses are also with difficulty invested that are situated on the bank of a large river, the conflux of two rivers, in the middle of woods and hollow ways, at a certain distance from them, or in general on ground which in any way prevents the besieging army from forming a connected circle. It is also very difficult to invest a fortress covered by a large army, or by an entrenched camp. In this case, the investing army has to occupy a very large space, by which its force will be more dispersed, and easily driven back by a concentrated attack from the garrison.

A fortress can either be invested by the army which is to carry on the siege, or by a corps sent forward before that army arrives. This will frequently be of great advantage, unless the fortress is covered by an army, which of course must be driven back before the siege or the investment can take place. It is always to be observed, however, that the investment of a fortress, or the movements and preparations for besieging it, are to be kept most secret, that in the fortress no particular preparations may be made, either in collecting stores, or reinforcing the garrison.

Necessary information previous to the siege.

Previous to the commencement of a siege, it is of the highest importance, if possible, to ascertain not only the strength of the garrison, but also the troops which it may be necessary to oppose in the neighbourhood, in order to determine the strength of the corps necessary to invest the place. This ought never to be so numerous as to impede the celerity or secrecy of its movements; but at the same time it must be sufficiently strong to encounter the force which may be opposed to it. The besieging corps must also be proportioned to the nature of the ground. If the country be open, a greater quantity of cavalry will be required; but if inclosed, the principal force must be infantry. This corps is to march without any heavy baggage, that it may move with expedition; and that no obstacles may occur from its marching in too large a body, it will often be necessary to divide it into several columns, which are all to rendezvous at a certain place.

Advance of the troops.

As soon as this corps has been collected, it approaches suddenly to within two miles of the fortress, where every avenue and passage to the place is immediately occupied. In some cases it may be necessary also, to fortify the position, to guard against a sudden attack from a reinforcement of the enemy. As soon as the corps arrives at its appointed place, small parties are sent towards the fortress, to bring away or destroy all kinds of provisions and forage, that the enemy may not profit by them. The same is also to be observed with regard to the cattle, and every thing else which may be of any service to the enemy. If, at the same time, reconnoitring parties can be of use, they are to be sent out; as also parties to drive back any reinforcements that may be sent to the enemy. Should a fortress be situated on the sea-shore, a fleet will also be necessary to blockade it; and, if possible, this must be some days previous to the investment, in order that the fortress may be inclosed every where, as soon as the troops arrive.

The corps which previously invests a fortress, should be careful in preparing the best position for the large army, as well as endeavouring to gain all possible information respecting the place, in order that every thing may be prepared by the time that the army arrives. If, however, the army be sent directly, it will be the business of the commander himself to choose the most advantageous position, and to obtain as much information as can be procured.

As soon as the investment begins, the engineers are to be employed in collecting necessary information respecting the exterior ground surrounding the fortress, as well as itself.

Plans of the ground.

All drawings which may have been obtained of the fortress and the country round it, are compared with the ground, and, if necessary, improved or corrected by actual surveys. If no plans of the fortress can be procured, the works, as well as the surrounding country, are surveyed, in which each engineer has his own work to finish. If instruments, as rulers with diopters, boussoles, sextants, theodolites, and plain tables, can be used, the survey will be executed with greater accuracy; but where these are not to be had, a single instrument for taking the principal angles will answer the purpose, and the rest may be filled up by the use of the camera lucida, and by telescopes with micrometers, as will be explained in another place. Plans of almost every fortress may now be had, and these plans are corrected by actual comparisons with the works themselves. All particulars, such as the lengths of the flanks, the faces, the curtains, the dimensions of the fossé, and all the outworks, are taken as exactly as possible; and, if necessary, an engineer is to go into the covered way, to examine every thing necessary in this respect. Spies may frequently be of use for this purpose, and from them, after being properly instructed, the best information may be obtained. It is also necessary to ascertain the disposition of the garrison and of its commander, as well as the quantity of its provisions and stores of every kind, and where they are placed, in order to know to what part the fire should be principally directed, or rendered of no use to the garrison. Workmen who have assisted either in building or repairing a fortress, can give valuable information to a besieging army, and therefore every means should be tried to discover them, as the intelligence to be gained from them cannot be obtained from any other quarter.

Communication between different parts of the army.

The camp of the army is to be regularly inspected, in order that every possible improvement may be made for the greater security and convenience of the troops. The magazines and stores of materials and instruments necessary for the siege, are to be made at different places, that the enemy, by their position, may not discover to what part of the fortress an attack will be directed. In entering upon a siege, the principal object of the commander is to see that a good communication is kept up between all the parts of the army, and that the necessary bridges have been constructed. Care is to be taken that these bridges are sufficiently large, and, if possible, there should always be two together, one of which may still be of use, even if the other should be damaged. But in the construction of these bridges, the besieging army should endeavour, as much as possible, to place them out of the reach of the enemy.

Army of observation.

Should an army of the enemy be expected, the country round the camp is to be fortified, if it appears advantageous; but care is to be taken not to inclose the army too much, lest its movements should by these means be embarrassed. Single but strong forts appear to be far more advantageous than any other, and are, therefore, more frequently adopted. A besieging army may also be covered by an army of observation, or a corps whose business it is to watch the enemy's movements, and either to protect the besieging army from an attack, or at least to give timely information if an attack is to be expected.

Circumstances must determine, whether the army of observation, or the besieging army, should be the stronger. If the army of the enemy is numerous, the army of observation is to be the larger. In most cases, however, it should, in the first instance, be the smaller, as it may easily be reinforced when necessary. Besides, the besieging army must never be very weak, lest it should fatigue the soldiers too much, and expose them to the attacks of a numerous garrison. To defend them from such an attack, strong but inclosed works, which cover each other, may be raised round the fortress, especially in such places as secure the communication with the different parts of the army, and at a convenient distance for mounting guns.

Position of depots.

In making arrangements for a siege, a most important consideration is to determine the position of depots and military stores. These should never be at so great a distance, as to produce any inconvenient delay in procuring the necessary supplies, of which a sufficient quantity must be collected before the siege commences. The first article required is ordnance. With this, therefore, and with every thing necessary to render it effective, the army must be amply provided the moment it has taken up its position. The quantity that may be necessary in any given case, depends upon the strength of the fortress, and other circumstances, which will be considered afterwards.

Necessary tores.

Next to ordnance, fascines, or rods and brambles for making fascines, are peculiarly necessary. These are either 8 or 12 feet long, and serve to construct parapets, traverses, &c. and sometimes also to fill the fossé, in order to pass it. The great number of fascines generally wanting during a siege, may sometimes be procured near a fortress, if sufficient wood of this kind is to be had in its neighbourhood, as they may be transported by land or water to those places, where the depots of these and similar materials are formed.

Gabions are also wanting for the construction of particular works, and therefore it is necessary to have either a number of them in readiness, or the rods of which they are constructed. Hurdles made of rods are also used in forming revêtements, supporting all excavations of the ground, and covering bridges, which are to be made over small rivulets. It is equally necessary in many cases, to have blinds and moveable parapets, for the purpose of covering the men who use small arms.

In the construction of earth works, a great variety of tools are necessary, such as shovels, spades, fascine knives, saws, hatchets, hammers, drills, &c. and of course a sufficient number of these must be kept in the magazines or depots.

ition of artil-

The park of artillery is placed as close to a fortress as possible, always taking care that it be not molested by the enemy's fire. The most advantageous position is when it is covered by a height, or rising ground, and at the same time well protected by the troops from the sallies of the garrison, and the attack of an army, to relieve the fortress. The park of artillery is always to be placed in a certain order. The heaviest guns should be stationed in one or two lines, the mortars and howitzers on each side of them, and those of light calibres at the wings. Every article belonging to each piece, including the horses, carts, &c. must be placed in a line close behind it.

The place where the fireworks are prepared, should not be far distant from this park, and the park must be as close as possible to that side where the attack, or where one of the attacks, is to be made. Sometimes, however, it may be placed before a different front of the fortress from that which is to be attacked, in order the better to hide the intention of the besiegers, or to take advantage of a more favourable part of the ground.

ings

The stores of ammunition are to be dispersed in several places, in order that the whole of the powder may not be blown up by any single accident. The buildings erected for this purpose being generally made of wood, and covered by a mound of earth, a ditch, and rows of palisadoes round them, are to be constructed at such places as are covered from the enemy's fire. These houses for the reception of the ammunition, or of the powder in particular, are to be made so as to keep the powder dry, and must consequently have a good roof, and some openings with shutters, which, in fine weather, may be opened for the free passage of the air. The powder is to be placed on boards, under which the air may pass free, and kept either in barrels or in chests, in the same manner as ammunition chests on the carriages.

The depots for the materials are also constructed near the front where the attack is to be made, that they may easily be conveyed wherever they are wanted. Sometimes, however, to deceive the enemy, or for convenience, a part of the depot may be conveyed to another front; but great caution is necessary on these occasions. It is not proper to place the whole of the materials in one depot, or too near storehouses, lest they should all be destroyed, and their destruction occasion damage to the storehouses also.

Sometimes palisadoes, and sometimes only a single ditch, is constructed round the depots; and here, as well as round the powder magazines, sentinels are placed, to keep all strangers or suspicious persons at a distance.

The tools and sand bags, or similar stores, may be kept at the depots of materials, but if possible under shelter, that wet, or other circumstances, may not injure them.

Front to be attacked.

The choice of the front to be attacked, will principally be determined by the knowledge that has been procured from the surveys, the weakest being always the most assailable. That side generally is considered to be the weakest which is commanded by eminences, or where the rampart can be hit at a great distance, where the terre-plein is very narrow, the bastions small, the construction or trace imperfect, the defence injudicious, the outworks weak, the covered way easily taken, the fossé small and not deep, the revêtement damaged, or not of stones, where there are no mines, and where the besieger's works cannot be commanded.

With regard to the surrounding country, a dry plain and open ground sloping towards the fortress is most advantageous. A stony soil particularly retards the siege, as also moorish ground. In these situations, the attack can only advance with a very small front, which is certainly very disadvantageous. Hollow ways, hedges, walls, or similar objects, may serve also to cover the besieger's works. If a country be rather low, it is of consequence to know whether it can be inundated, which is a very serious disadvantage. The side of attack also, in some measure, depends on the manner in which the ordnance and fascines can be transported. The fortifications and their strength, however, generally determine the point, when the other circumstances are not very unfavourable.

Plan of attack.

The next thing to be considered is the plan of the attack, which ought to be such, that all the works shall be conducted regularly, and as few as possible constructed, so that the fortress may be taken in the shortest time. All this is the business of the officer who is to conduct the siege, and who is always present to direct and controul every thing on the side of attack. The works constructed by the besiegers as a defence from the fire of the fortress, are in general called *trenches*. Of these there are different kinds, as approaches, parallel batteries, and traverses.

Approaches and parallels.

Plate CCLIX. Fig. 1.

Approaches are excavations about 3 feet deep, and 10 to 18 feet wide, the earth of which is thrown towards the enemy in order to cover them. The direction of these works is towards the place, but generally zigzag, so that they always approach the fortress in such a manner, that none of them can be enfiladed. They are represented A, A, A, Fig. 1. Parallels are also excavations, about 3 to 3½ feet deep, and 20 to 30 feet wide, the earth of which is thrown towards the enemy. They are constructed parallel to the front of attack, as B, B, B. Behind the parapets are made banquettes, for the soldiers to stand upon, as in other fortifications.

Batteries are places for guns, being mounted on platforms, round which a parapet and a ditch are constructed towards the enemy.

Batteries, &c.

Traverses are similar to the works of the same name formerly described. They consist of mounds of earth, and are constructed, to hinder certain lines from being enfiladed, or to cover troops.

Cavaliers of the trenches are traverses 10 to 12 feet high, constructed on the saliant angle of the glacis, about 10 to 30 feet from it, in order to enfilade the covered way, and to drive its garrison out of it. There are steps behind, by which to ascend them.

Distance of the parallels.

The approaches and parallels are conducted according to certain rules, the capital, and its prolongation in the field, being the principal line for the construction of all the works. On a plan of the fortress, these capital lines are drawn, and the first parallel laid down at about 600 to 1000 paces distant from the covered way. The approach or communication between the camp and the parallel is next determined, in such a manner, that the angles of its zigzag are as near to the capital line as possible, and that they form the shortest unenfiladed way to the parallel. The nearer the trenches come to the place, the smaller are the turns and the angles of the approaches; but the longer time will be taken in approaching the fortress. That part of the approaches which is the most distant from the fortress, is called the *tail*, and, on the contrary, that which is the nearest to it, the *head of the approaches*.

Form.

PLATE CCLIX. Fig. 2.

The first and second parallel, when a fortress is not very strong, are generally like those represented in Fig. 2; but if the polygon which is attacked be well fortified, Fig. 1. is preferred. The third parallel is generally constructed at the foot of the glacis, and a fourth is sometimes also necessary.

Different kinds of batteries.

The figure of the parallels, as well as the approaches, being thus laid down, the places of the batteries are next determined. There are three different kinds of batteries, viz. dismounting, ricochetting, and breaching batteries. The former serve to dismount guns, or so to damage them, or the parapet before them, that they must be withdrawn, and that the men behind the remaining parts of the parapet may be exposed to the fire as much as possible. Ricochetting batteries serve to enfilade the lines, in the prolongation of which they are placed. This consists in firing with small charges at a particular elevation, by which the shots roll along the inside of the parapet. Breaching batteries serve to make breaches in a work, or to destroy a part of its revetement, rampart, or other inclosure, in such a manner that it may be attacked and mounted with little or no difficulty.

Ricochetting.

The ricochetting batteries are generally placed at the first or second parallel, in such a manner that they may enfilade the faces and flanks of all the works on the front which are attacked, and even some of the next, as also the covered way, and the works situated before it. They are therefore constructed in their prolongation of these lines. The dismounting batteries are generally constructed at the second and third parallels, or between both; and are parallel to such works as they are intended to annoy.

Breaching.

The breaching batteries are sometimes at the last parallel; but they are still more advantageous when on the crest of the covered way.

The guard of the trenches.

The guard placed for the defence of the trenches should never be less than the garrison of the place. It always remains 24 hours in the trenches, and is generally relieved towards the morning. If possible, this guard is always composed of whole battalions, but never of too large a force from one part of the camp, lest that part should be too much weakened. The sentries in the trenches are to be as numerous as possible; and they always give notice of every shot of the garrison, that every one may secure himself. Cavalry are ordered to cover the ends of the trenches, and to make an attack on the enemy's flank, if he comes out of the fortress. The whole guard of the trenches is commanded by a general; but besides this, the major of the trenches has the immediate superintendence of them, and of the police there. He shews each battalion its place, and gives every commander his proper instructions. He generally has two to four assistants, and is always accompanied by some orderlies, to execute his orders. It is his business, also, to attend the market, to order the provisions, and to see that a proper degree of cleanliness is observed in the trenches.

All works which are to be constructed in one night are previously determined, and proper instructions given, that they may be executed with regularity and the greatest possible dispatch. The engineers, and all overseers of the workmen, are therefore in particular to be well instructed.

Opening of the trenches.

The first part to be executed in the plan of an attack is the opening of the trenches, which is done as follows. The workmen, and the men ordered to cover them, or afterwards the guard of the trenches, are to collect in the most secret manner, in the evening, at some place not far distant from that where the attack is to be made. As soon as dark, about 200 to 300 of the best men are sent towards the fortress to draw a line, or to compose a chain of posts parallel to the front of the attack towards the fortress. After these soldiers, who must all be men in whom the greatest confidence can be placed, and who are to be cautioned not to make the least noise, and to see that no one shall desert, follow the engineers, each at the head of a file of workmen. The latter all follow one another, observing strictly the movements of the engineer, who marches on the line which is to be dug out by his file during the night.

The workmen being thus conducted to their stations, they are carefully inspected by the engineer and his assistants, to see that every man is in his place. Each then lays down his fascine, which has previously been given him, and digs in as fast as possible behind it, the fascines being placed by the engineer, or his assistants, in such a manner as to mark the interior crest of the slope of the mount before the trenches, towards the enemy. Every man digs in as soon as possible, to cover himself, in which respect they should be properly instructed by a few words from their leaders, with whom they have to march. Behind these workmen, the rest of the guard of the trenches are to follow, and are placed about 20 to 30 yards distant from the workmen, who form the first parallel.

The workmen should, if possible, consist of soldiers, as labourers give rise to much confusion, without doing more work than an equal number of soldiers. The number of workmen is determined by the length of the line to be dug out, or when great expedition is required one foot, two feet being allowed for each man. Care is always to be taken, however, that there be not so many men as to cause confusion, and therefore it is better to employ no more than are absolutely necessary. All the

The first parallel.

men employed in this undertaking should be perfectly healthy, that they may not by coughing, or any other noise, alarm the garrison. They are always to be accompanied too, by the necessary number of officers and non-commissioned officers, to keep them in order. As soon as they are collected in the evening, the engineers divide them, each takes his number, and explains to them the nature of the work in which they are to be engaged. The fascines and tools are then given out, and all follow the engineer, as was before observed. In the first night, the first parallel and the approaches towards it are constructed, each engineer having a guard of from 200 to 300 men. That the engineer may have no difficulty in finding his way, the lines to be dug out are previously marked by a cord passing along a row of small poles, fixed in the lines at convenient distances. This cord may be fastened by one man after it is dark, or even at any other time; but particular care must be taken that no part of the trenches can be enfiladed. If any kind of sortie or surprise is expected on the part of the garrison, the workmen must always be provided with a sufficient guard; and that this guard, as well as all the engineers, may be better able to find their way, sometimes men are placed at certain distances in the evening, before it becomes dark, if that can be done without being discovered by the enemy. Small fires or lanthorns are also used on some occasions with advantage.

As soon as the guard arrives at its post, or in the line which it is to occupy, it pushes a sentry towards the fortress at every 10 paces, or even at a smaller distance, if necessary, who lies down, in order to observe every thing that passes in or near the place. The bulk of the guard of the trenches may be near the workmen, when an attack is expected; but it is better to place them near the depots, and at such a distance that it may advance to support them on the first notice or alarm.

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As soon as it becomes light, the workmen retire, and the guard before them also. The guard of the trenches occupies their place; and new workmen are sent to finish such parts as have not been completed during the night. Should the enemy discover what is intended, and perceive the opening of the trenches, he will either fire at them, or attempt a sortie to attack the workmen. Should the garrison frequently send patroles from the fortress to observe what is going on in the trenches, these patroles are to be made prisoners, if possible, without, however, firing upon them. This may be done by a small party making a circuitous route, permitting the patroles of the enemy to pass, and then cutting off their retreat. Should the enemy have reason to suspect an attack, he will throw light, and fire balls, to see the besiegers, and then direct his fire at them; but the men in the trenches will receive very little injury from this fire, as, from the circumstances under which it commences, it must be very uncertain. The workmen, however, will probably be frightened, and run away. This, if possible, is to be prevented, by representing the little danger to which they are exposed; or, if necessary, they may be withdrawn for a certain time, till the enemy's fire ceases. If, however, the men have already proceeded so far in their digging, as to be nearly protected from the enemy's fire, they are to continue their work, and no one is allowed to run away or to leave his post, on any pretence whatever. Should the enemy, however, have a large garrison, and hazard a sortie, or an attack upon the workmen or their guard, the workmen may be brought back to the places where they were collected, or to a proper distance, while the guard of the trenches advances to oppose the enemy. In such cases, cavalry to cut off the enemy's retreat should always be ready. The workmen never should be allowed to disperse, but always be kept in order; and disobedience should be punished on the spot with death, if necessary. Strict discipline, added to a conciliatory mode of informing and instructing the men in their duty, will be of the utmost advantage, and is never to be neglected. The workmen who come at day-break, and even some of the guard of the trenches, may be usefully employed in completing either the communication or the parallel begun in the first night. The next morning after the opening of the trenches, the engineers inspect it, and observe whether the enemy can enflank it. Where this is the case, they order a traverse to be constructed. They also see, that in the parallel the banquettes for the soldiers to fire from are properly constructed, and that the crest of the parapet is as nearly of the same height as possible.

Construction of ricochett batteries.

As soon as the first parallel has been finished, the ricochett batteries are constructed. These are placed either in, before, or behind the parallel, according to circumstances.

The space between every two guns is generally 24 feet; and between the mortars, about 15. The depth of the batteries is from 30 to 36 feet; and a powder-magazine is generally placed behind them. The guns on such a battery are mostly placed at the ends, and the mortars in the middle. Besides the ricochett batteries, others are constructed to fire at the magazines of the fortress, in order, if possible, to detroy them. Such batteries also may be advantageously constructed, even before the trenches are opened, on heights commanding the town; and mortar-shells filled with combustible matter, or red hot balls, as well as fire-rockets, may here be of great use, in obliging a fortress to surrender long before a breach has been made. A battery in the parallel, however, is constructed in the shortest time, and therefore often the best. Its construction is as follows: The parallel is made equal in width to the depth of the battery; the platforms for the guns are laid; the inside of the parapet is finished to the height of the soles of the embrasures, and the embrasure begun; then the parapet is finished, and afterwards also the embrasures, which generally, as well as the interior talus of the parapet, are lined with fascines. The batteries for mortars have no embrasures, but are lined like those for guns. The parallel is in this case conducted round the battery, viz. behind it, in the same manner as PARALLELS are built. The battery has generally a parapet, either at its flanks, or before them, but none behind.

A battery before or behind the parallel is dug out, in quite a different way. The inner talus is determined at first at a proper distance from the parallel and fascines being laid down to mark it out, a ditch is dug out before it, and the parapet constructed in the same manner as directed in field-fortifications, observing the above rules with regard to the construction of the embrasures. The two wings or flanks of such a parapet are joined to the parallel, and serve to secure the communication with it. At the back of these batteries, generally behind a small traverse, a powder-magazine is constructed to contain ammunition enough for two days, or about 200 shots for each gun, and 150 for each mortar.

The men employed to construct such a battery, should be acquainted with the work. These batteries being also constructed during the night, will hardly be complete

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that a proper tunnel or excavation may be made by it for constructing a lodgement.

The first method of attacking by mines, is to make a subterraneous well towards the covered way, of about 4 feet square, and when this has been carried to a proper distance from the third parallel, a place is to be formed for depositing the charge; the mine is then to be filled, blocked up, and fired. Experience is the best guide in determining the quantity of powder to be used.

In this manner the work proceeds, till it arrive near the covered way. As soon as a tunnel of a mine is formed, a lodgement is directly made there, that the troops may advance and take possession of it, and thus gradually approach the fortress. If some of the enemy's mines and wells are met with, or if his miner is heard, a mine is directly to be filled and burst, before he has time to do so with any of his. But should the miners be destroyed by the enemy bursting his mines, new ones must be begun, which there is reason to expect will be more successful, as the enemy will then have no more mines at his command.

Subterraneous engagements.

If the miners should chance to meet those of the enemy, a subterraneous engagement will ensue, in which smoke-balls, for producing a poisonous and suffocating smoke, may be of use. If they succeed in driving the enemy out of the mines, a large one is to be made, and the whole blown up as soon as possible. In all cases it will be necessary to keep the most accurate drawing possible of the progress of the mines, executed from actual surveys.

Destruction of the enemy's mines.

If one of the enemy's wells be discovered, it is to be filled at certain spaces with quantities of powder; these are to be blocked up properly, and the whole exploded, in order to form a lodgement or an approach, which, after bursting a mine, is finished by the sappe. In mining, it will sometimes happen that the ground is not firm enough, or that springs are met with, and that the miner is unable to proceed, in which case new wells are to be dug out, as before. The depth of these wells should, if possible, be 20 to 30 feet below the ground. Large mines are always very advantageous for the besieger, as they favour the construction of lodgements; but small mines, which are not seen on the surface of the ground, are of the greatest advantage to the besieged, as they are of no use to the enemy, but serve to destroy his works, and to obstruct his advances.

The mines used to take the covered way may also be applied in destroying the traverses, and even the places of arms.

Breaching batteries.

As soon as the covered way is taken, and the lodgement on it finished, the construction of the breaching batteries is begun, and, if possible, in such a way that the angle of the shoulder may be struck by the balls in a perpendicular direction. But if this cannot be done, and if the front has a large demi-lune, the breach is to be attempted, 10 to 15 yards from the angle of the bastion.

The breach in the ravelin is made so as to destroy the intrenchments formed on it, at the same time that the breach is made; or if this is not possible, the breach is laid 10 to 15 yards from its saliant angle.

Breaches in counter-guards, lunettes, manteaux, &c. are laid as in the demi-lunes, or nearer to their saliant angles.

At the same time, with these breaching batteries, dismounting batteries are also constructed for destroying the flanks. The breaching as well as the dismounting batteries are constructed by the aid of the sappe, in a manner similar to that before described. But sand-bags and wool-bags are here also of considerable advantage, and where they are to be had, they should always be used. The fire of these dismounting and breaching batteries is begun as soon as they are finished, but never sooner, that they may not be exposed too much, while they are in an unfinished state. The shots of one battery are fired at the same time, and directed at about one-half of the height of the revetement. Every embrasure is to be advantageously blinded with a gabion, a wool-sack, or a bundle of fascines, while the men are charging the guns.

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Approach to the fossé.

During the discharge of the guns for dismounting the rampart and making breaches, the passage into the covered way is to be formed by the sappe, and from that the way to the fossé is made, either by a subterraneous passage, or by the double and covered sappe. When the subterraneous passage is formed, it is to be lined and covered with wood, and carried on to the revetement of the counterscarpe. This is penetrated either by a small mine, or by piercing it, and making an entrance, which is to come about two feet above the surface of the water, or as much above the ground of a dry fossé.

Passage of the fossé.

The passage over the fossé is differently constructed, according to the nature of the fossé. A dry fossé may be passed by a double or by a covered sappe; a wet fossé, where the water does not flow, by a fascine dam; and a fossé where there is a current, by a kind of fascine dam constructed on scaffolds to let the water pass by.

The sappe over a dry ditch is made, as described above, either by mines, or like a double or a covered sappe.

The dam over a wet ditch, where there is no current, has two parapets; one at each side, if the enemy's fire is to be feared in passing the fossé, even though all his guns at this time should be dismounted, or at least unfit for use on the attacked side. The dam is regularly and successively constructed, by forming a layer of fascines, and covering them with earth, and continuing with this till it be sufficiently high, then the parapet is constructed, a new part begun, and the work proceeds thus till the whole is finished.

A dam over a fossé which has a current, is more difficult. The first thing is to try whether the current cannot be stopped, or the water let off. When this is impossible, the scaffolds are placed gradually, the intervals are filled with fascines, the upper part formed also with fascines and earth, and then the parapet constructed. The weak parts are then strengthened, so as to guard as much as possible against all accidents.

The last part of such a dam generally is a bridge, which is constructed of long rafters, and covered with fascines and earth like the other parts of the dam.

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When the dam or passage over the fossé is completed, the assault is determined upon, and secretly and unexpectedly undertaken an hour before day-break. The outworks generally are taken before the bastions can be assaulted, but sometimes, and as often as circumstances allow it, the outworks are either passed, or the bastion and the outworks attacked at the same time. As soon as a practicable breach has been made in the rampart, a sufficient number of volunteers assault the work, and in general soon get possession of the place. If the garrison retires to an entrenchment, that also must be immediately assailed; but if this cannot be done, the soldiers lie down, and cover themselves with wool-sacks, till the lodgement is formed by a number of workmen ordered for this purpose to accompany the soldiers who make the assault.

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If this lodgement be practicable for receiving troops, it is directly to be occupied, and this must be done by day-break at latest, that the men may not suffer too much from the fire of the enemy's small arms. Such lodgements are most expeditiously formed of sand-bags, wool-sacks, &c.

How to be renewed if unsuccessful at first.

If the assault has been repulsed, or if the lodgement has not been made in such a way as to be occupied by the men, and if they have been compelled to leave it, the attack is to be renewed as before. If any apprehensions are entertained of the enemy's mines, it will be necessary to send the miners to lay a mine and to burst it, in order to form the intrenchment or lodgement there with more ease, or to force the enemy to leave it before the assault has taken place. Works in the gorge of an outwork or a bastion, will frequently prove great impediments to the besiegers, and therefore they should be molested by shells, or be undermined, and thus rendered assailable. But if neither of these be sufficient to force a work to surrender, a breaching battery is to be constructed before the lodgement made on this work, in the same manner as before directed, and then a regular assault is to take place, as observed of outworks or a bastion. A fortress which is taken by assault is sometimes given up to plunder; but this very seldom happens in modern times. If, however, it should be the case, and the assault has succeeded, the gates are immediately to be opened, and patroles of cavalry are sent to preserve order. This last precaution becomes more necessary if the enemy retires to the citadel. If no plundering is allowed, heavy contributions may often be raised, and divided among the soldiers.

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If a fortress has capitulated, or surrendered by a treaty, one gate is directly to be occupied, but no person allowed to pass without a proper passport. The articles in the treaty and capitulation are executed, and an inventory made out of all stores, provisions, &c. taken possession of. Of these articles, farther notice will be taken in a subsequent part of our subject.

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Should the garrison, however, by some means or other, force the besiegers to raise the siege, it is done as secretly as possible. The stores of ammunition are all fired away, or left behind; and the guns of light calibres continue their fire, till all the large ones are withdrawn. The former are then brought off, followed by the garrison of the trenches. All that is left is then set fire to, or destroyed, and pieces of ordnance are spiked and rendered totally unfit for use.

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The siege of a fortress situated on a mountain is more difficult than if situated in a plain, as the trenches will frequently be so completely commanded from the fortress, as to render the progress of the works on that side impracticable. In this case those parts must be attacked, where advantage can be taken of ravines, hollow ways, or other local circumstances.

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Fortresses situated in a moor, or surrounded with water, so as to communicate only with firm ground round it, by dams or small necks of land, are to be attacked on those parts; and a sappe may be conducted on them, so as to approach covered. To make the parallels longer, or to construct batteries upon, or by the side of these dams, sacks filled with earth may be usefully employed: the passages made over these earth-sacks are covered with boards, or fascines, to ensure a firm footing, and that they may be fit for carrying guns.

If the water round a fortress be so deep as to carry boats with guns, either these, or batteries built on rafters or floats of wood, are to be stationed at proper places to bombard the fortress. This is also to be done from several points, where the fire can reach the fortress, in order, if possible, to destroy the stores and provisions there.

on a rocky soil.

Fortresses situated on a stony or rocky soil are difficult to be attacked, and the works round them can only be constructed by earth or wool-bags, and by fascines.

Case of a town having a citadel.

Should a town have a citadel, it will be necessary to consider, before commencing the attack, whether the citadel or the fortress is to be assailed first. In all cases where the citadel commands the fortress, and where it will not be much more difficult to attack it than the town, the first efforts should be directed against the citadel, and not against the fortress. When a fortress is to be attacked in form, the operations may frequently be shortened, by forming a *brusque attack*, or beginning with the construction of the third parallel as the first works of the trenches, and afterwards making a communication from that to the camp. The attack proceeds then regularly, and ricochett batteries, as well as dismounting and breaching batteries, are constructed as before.

Brusque attack.

Attack by tirailleurs.

The last method of attacking a fortress is by tirailleurs. Batteries are constructed at a great distance, and mounted with mortars and guns of large calibres. As soon as these batteries have begun their fire, a chain of tirailleurs is formed all round the fortress, who approach the works, covering themselves by the excavations and elevations of the ground, or by the pits, ditches, hollow ways, ravines, trees, houses, walls, hedges, &c. &c. From such places they fire at every one who appears on the rampart, or any other of the enemy's works. The tirailleurs should always take aim, and avail themselves of every circumstance that may direct their fire with effect. In general, they have little to fear from the fire of the garrison; but, if necessary, they are still better covered, by giving them wool-bags, or by constructing a parallel for them, and also by combining their operations with a brusque attack. These tirailleurs always approach the fortress by degrees, and inclose it as much as possible, until the covered-way can be taken by storm; and the attack is afterwards continued as circumstances may require.

The men ordered for this attack are to be properly instructed in their duty, and besides, rewards are promised to them on their executing it completely. They always retire at night, or when dark, and reappear before day-light, in order that their fire may begin with the dawn of day. While this attack of the tirailleurs is going on, the ordnance also endeavours to annoy the enemy; and ricochett batteries may be constructed to assist the others. These, however, may be brought closer to the fortress, to increase their effect. This method of attack was first practised by the French in the revolutionary war, with great success; and, combined with the attack in form, it certainly does appear well calculated to force an early surrender.

Defensive measures adopted by the garrison.

Having traced the progressive operations of the besiegers from the first opening of the trenches to the surrender of the place, we come now to consider the defensive measures adopted by the garrison.

Preparations for a siege.

A fortress, where a siege is to be expected, should always be put in the best possible state of defence; by repairing all the works, placing the palisadoes, constructing the necessary traverses, and, in short, neglecting nothing which may render it stronger. The ravelins should have reduits and weak fronts, strong places of arms, and lunettes, all of which are to be executed before the siege commences. A sufficient quantity of ammunition, ordnance, materials for repairs, and other military stores, is also to be provided. Embrasures are to be constructed, and the ordnance partly mounted. Powder magazines are to be formed in secure places, and at proper distances from each other, and such fire-works prepared as may be used during the siege.

Hospitals, &c. to be provided.

Care is also to be taken that the hospitals and shell-proof lodgements be put in a proper state of repair; and, where such works are wanting, blindages are to be constructed. These consist of buildings of wood and large rafters, composed of two walls, which incline towards each other, covered with earth, so as to be shell-proof, and protected at the ends by traverses. Sometimes these blindages are composed only of one such inclined wall of wood, covered with earth, in which case it is placed towards a rampart or a traverse. Sometimes old buildings, the roofs of which have been broken down to make its upper side shell-proof, serve as places where the garrison may reside with safety. Only stone-houses, however, are chosen for this purpose.

Inhabitants how to be treated.

The inhabitants, unless their loyalty be suspected, are to be divided into parties, and employed as circumstances may require. The surrounding country is to be rendered as level as possible, that the enemy may nowhere approach covered. The bridges round the town are to be destroyed, and every thing removed that might contribute to keep up a good communication among the besiegers troops, that they may have to replace it before the siege begins. Sufficient quantities of fuel, and provisions of every kind, are also to be collected from the neighbouring country, and patroles or parties are to be sent out to observe the enemy's manœuvres. Among the different corps of the army signals are agreed upon, so that, if any troops should arrive for the relief of the place, the garrison may be able to communicate with them, and act in concert. Messengers and spies are also engaged, to procure information of the enemy's movements, and to keep up a communication with the army or other fortresses.

Provisions to be collected.

Precautions against a surprise.

In order to guard against a surprise, the most unremitting vigilance and attention are absolutely necessary. Each must have a full and perfect knowledge of his duty, and the place he has to command. As soon as the enemy is within 36 miles of the fortress, frequent patroles of cavalry are to be sent out, to gain hourly intelligence of his movements. The gates should never be opened before daylight, nor a number of men allowed to enter at once. The guards of the gates should be doubled by night. All channels, posterns, &c. are to be kept shut up. Every person who goes out or in must be strictly examined and carefully observed, particularly the deserters of the enemy. Should a conspiracy be suspected in the town, the inhabitants are to be menaced and disarmed, and all meetings are to be dispersed. Strong cavalry patroles should be constantly sent through the streets. The garrison must be kept in good spirits; and, if possible, after great fatigues, some extra allowance, either in money or otherwise, should be made to them.

Strict discipline to be observed.

The quarters of the men belonging to one troop should always be close together, that they may easily collect; and the commandant should frequently make trials of their watchfulness, by giving false alarms, and keeping them constantly on their guard, taking care, however, not to fatigue or harass them too much, and never suffering any neglect of duty to pass unpunished.

How to repel a surprise.

A citadel is always very useful in the event of a surprise, as the troops may collect there, and act against the enemy with more regularity, and with a greater chance of driving him back. Besides, the possession of a town commanded by a citadel is of very little use to the enemy. But should a surprise have taken place, all the troops are to collect at the spot fixed on, from which they proceed to join on the places to be defended. As soon as the greater part of the garrison is collected, detachments are sent to the different streets to repulse the enemy, and particularly to reinforce the gates, to prevent a greater number from entering the town. The enemy may thus regularly be repulsed, and even a part of his troops be cut off.

If the garrison, however, is too weak to defend itself, it must retire to the citadel, or look out for a safe retreat. Should the inhabitants take part against the garrison, it will be necessary to set fire to the town in several places. But the greatest attention of the commander is necessary to prevent disorder, as this alone will increase the loss more than any thing, and therefore the necessary instructions are to be previously given, that every one may know his place and his proper duty in case of a surprise. In an open attack, the defenders have great advantages over the assailants, and these being duly considered, and properly represented to the garrison, will contribute much to increase its spirit. When such an attack is expected, great care is necessary in making the most judicious arrangements, both with regard to the works that ought to be defended, and the number of men requisite for that purpose. The plan of the enemy must if possible be ascertained by spies, or some other secret means. When the side of the attack is known, fire and light balls are to be thrown in that direction, and, when the enemy is perceived, he must be opposed with grape shot.

Open attack.

Resistance at different parts.

As soon as he arrives in the fossé, grenades, shells, and other artificial fire-works, are to be used. When he attempts to mount the rampart, large trees, and other heavy bodies, are to be rolled over the parapet upon him; and should he arrive, bayonets must be used. If he succeed in getting possession of the rampart, he must be charged by the cavalry, and reinforcements of infantry. Should these also be repulsed, the streets are to be defended, and finally the signal given for retreating to the citadel, which should be done with the greatest possible order.

Defence against a blockade.

The defence against a blockade, consists in having plenty of stores and provisions, and magazines where they can be safely preserved. All unnecessary persons are to be sent out of the town; the inhabitants that remain, are to be ordered to lay in a sufficient stock of provisions, and premiums promised for the importation of these articles. Such provisions as are in the place must be properly distributed, that they may not be consumed in a useless manner. Should provisions be scarce, the houses are searched, to know what stores the inhabitants may have, of which a part may be taken for money if necessary. Should money become scarce, some of it may be stamped to increase its nominal value. Copper may be coined, or loans contracted. The garrison besides should have safe habitations; and sometimes sorties or attacks must be made, with smaller or larger parties, against the enemy, in order to annoy him, and to procure provisions. If, however, these sallies prove unsuccessful, great care is to be taken that the enemy does not penetrate into the fortress with the troops who make the sortie.

Defence against [illegible]

The defence of a place against *an attack in form*, is subjected to greater difficulties. The first thing necessary, is to obtain a knowledge of the enemy's designs. The fortress which the enemy is most likely to besiege, may be known by the march or the quarters of his troops, by his intention to conquer a certain province, by spies, or by information collected in the enemy's country. The commandants of fortresses should always advertise one another of such movements. Should a corps, with a great number of engineers or heavy artillery, arrive near a fortress, the commandant may be assured that such a circumstance is preparatory to a siege. In this case he immediately visits every part of the fortress, and orders all necessary repairs. The superior officers are assembled as well as the magistrates, and the commandant informs them of his intentions as far as necessary, and menaces with punishment, those who may act contrary to the orders which he shall issue.

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The garrison is then properly divided, that no part may have more labour to undergo than another; and never should too large a number be ordered on duty, unless the fortress has a very numerous garrison. A journal is to be kept, in which every circumstance that may occur during the siege is entered.

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If every thing has been prepared, and the enemy's engineers should make their appearance, they are to be received with a discharge of grape-shot or balls. This only, however, in case of their approaching in parties, as this sort of ammunition is never to be wasted on a single man. Small calibres are generally used for this purpose, to prevent the besieger from becoming acquainted with the range of the ordnance. That the engineers may not approach during the night, small posts are placed before the covered way. The commandant also takes care to keep up a communication with the army, or the neighbouring fortresses, that, if succours arrive, they may be able to enter with facility. Should any parts of the enemy's camp lie within reach of the fire of the garrison, it is to be cannonaded as soon as finished, but not sooner. To prevent the enemy from getting acquainted with the weakest side of the fortress, a great smoke may be made, by burning straw, or firing smoke-balls of various kinds, so as to conceal several fronts. Sometimes also false drawings, or similar devices, may serve to give the enemy an erroneous idea of the strength of different fronts.

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The side which the enemy is determined to attack, may be known from the situation of his depots of materials, and from seeing the engineers constantly at work. This front, in particular, is to be put into a proper state of defence, the country before it being illuminated during the night by fire-balls, and outposts must be placed before the covered way. Small works are here also useful, in making the besieger begin his first parallel, as well as all his others, at a great distance. When it is necessary to leave these works, to prevent the enemy deriving any advantage from them, their parapets are to be sprung and destroyed by small mines.

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When it has been discovered, by means of spies or light balls, when and where the enemy opens his trenches, a constant fire must be kept up, in order to disperse the workmen. Next morning the engineers are to survey the enemy's work, and a fire opened on such parts of them as can be enfiladed. In the beginning of the siege, a strong fire ought to be kept up, to hinder the enemy from completing his works; but afterwards it is directed only to those places where it may be of the greatest use, particularly where the enemy has to construct his batteries.

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Should the enemy's batteries be finished, the guns are rather to be withdrawn than destroyed; but if one of the enemy's batteries can be dismounted, all the force is at first directed against one merlon, and then against the others successively.

Such parts of the fortress as have been damaged must be repaired during the night, that they may be in a proper state for service the following morning.

Riflemen how to be employed.

Should the enemy's parallel come so close to the covered way, that the fire of small arms can reach it, riflemen should be placed there, to fire at every one who may approach the trenches, particularly when the engineers or officers appear. The fire of the riflemen should also be directed against the head of the trenches, or where they are not quite finished, as also where batteries are to be erected.

Counter approaches.

For the same purpose also, small pieces of ordnance, and in particular small mortars, placed in the saliant angles of the covered way, may be used with the greatest advantage. Counter approaches are sometimes used; but certainly they are of no benefit, it being ridiculous to suppose that a garrison can, with any advantage, besiege the army by which it is itself besieged.

Sorties or sallies.

Another means of defence against a siege are sorties or sallies, for the purpose of procuring provisions, opening a communication with the army, or attacking some part of the enemy's works. They are undertaken sometimes before, and sometimes after the place has been invested; and they differ in the strength of the parties employed, according to the object in view.

Distant sorties.

Sorties against the enemy at some distance from the fortress, are sometimes liable to be cut off, and therefore only to be undertaken when the retreat can be secured. As such sorties also generally cost a great many men, they should only be undertaken when there is a fair prospect of obtaining some particular advantages, and where the garrison is so strong that a sufficient number will remain to defend the fortress properly.

Strong sorties.

Sorties which require a strong force, should never be undertaken unless they have a particular object in view, and then they are to be made by a sufficient number of troops to execute it without difficulty. Particular circumstances sometimes determine a garrison to make a strong sortie; but it is never in this case to be done if the men could afterwards be of greater service in the defence of the fortress. What relates to the execution of these sorties, the nature of the ground, and the different movements, will be farther illustrated under other articles.

Small sorties.

Small sorties are generally made by parties of about 20 to 30 men, who secretly leave the covered way, and attack suddenly with great noise. They then destroy every thing belonging to the trenches, or set fire to them, spike up the enemy's guns, overload them, &c. for all which purposes they are provided with the necessary assistance of workmen, tools, and materials, taking care always to retreat as soon as the enemy's reinforcements arrive. These little attacks are particularly useful after a mine has been sprung, before the garrison of the trenches has recovered from its fright, and order restored.

Best time for sorties.

The most advantageous time for attacks is midnight, or towards morning, when the troops in the trenches are still fatigued by their labours during the night.

Sallying parties not to be too long.

But no sortie should be made with two large a force, lest the enemy meanwhile make a successful attack on another part, while the largest force has been drawn farther away from the fortress. In general the number of men employed in a sortie should never exceed one half of the garrison. Small garrisons should never make a sortie with more than one-fourth of their number, unless it be to open a communication for retreating with all the garrison. The retreat from a sortie is always to be covered by some infantry and cavalry, but particularly by riflemen in the covered way, and by ordnance mounted on the ramparts.

Defence of the covered way. The defence of a common covered way can only be made by soldiers being placed there, and covered by the traverses. They keep up a constant fire towards the enemy's works, particularly during the night, and towards the head of the sappe, in order to prevent him effecting his lodgement along the covered way. If there is reason to suspect that a forced attack will be made on the covered way, it will be advantageous to place a greater number of soldiers to defend it, as also to make small mines under the traverses, and even under the glacis, where the enemy has to construct his lodgements. The hearths of these mines should be close to the work in the re-entering angle. If the enemy has driven the garrison out of the covered way, and it has retreated from one traverse to the other, and to the places of arms, the mines are sprung gradually, and also those under the glacis. But if the enemy has entered in a disorderly manner, he is to be attacked, and if possible repulsed.

The soldiers in the places of arms, as well as some small guns placed there, will always most beneficially direct their fire upon the enemy, and be particularly useful in taking him in flank, or in firing at him when advancing or retreating. Should the covered way be attacked by the sappe, the construction of the cavaliers of the trench is particularly obstructed by a constant fire from the covered way.

Counter-mines. A polygon, where there are counter mines, may always be defended longer than where there are none. If the enemy should not begin to mine, the garrison must endeavour to spring theirs under some of his works, particularly his batteries. This will retard not only his advancing from the third parallel, but also force him to commence mining. The most favourable moment for making an attack on the enemy, is after a mine has been sprung, and therefore a sortie is then to be hazarded.

If the enemy has begun to mine and to dig a well, it will be necessary to discover the place, and immediately spring a mine under it. This is repeated as often as he can be discovered.

How to detect the approach of the enemy's mine. The near approach of the enemy's mine may sometimes be detected by placing a drum on the ground, and scattering a few peas on its top. If the miner be very near, his digging will communicate a tremulous motion to the drum, and of course to the peas. When this takes place, the countermine is immediately to be sprung. If the enemy's well is discovered before the countermine is ready, the former may be filled with the poisonous smoke of fire-balls. The miners ought always to be armed with large pistols, to defend themselves should they fall in with those of the enemy. In this case subterraneous fortifications will also be necessary.

Small works in the saliants of the covered way. If there be any small works in the saliant angle of the covered way, they will keep the enemy at a certain distance as long as they can be occupied, and therefore this is done till he is ready to assault it, and even then they are not to be left, unless it be found impossible to defend them.

Avant-fossé with water. An avant-fossé that is full of water, is frequently of great use, as it prevents the enemy from passing it, or constructing a bridge, as long as there are guns to enfilade it.

Second covered way. A second covert way, particularly if it has a strong work in its re-entering angle, is also useful, and keeps the enemy some time longer; but in defending it, care is to be taken that it is not surprised, when the covert way before it is taken. In order to deceive the besieger as much as possible as to the number of ordnance in a fortress, the fire should be directed principally at the first parallel, at the batteries, and at the head of the sappe: in all others it may be slackened, which will induce the enemy to believe that many of the guns are dismounted.

When the enemy approaches the covered way, and is endeavouring to construct his lodgement there, or to effect his passage over the fossé, the guns that have been preserved are to be opened upon him, and an unremitted fire kept up as long as they are fit for use.

Such works as have sustained much injury, are always to be repaired with all possible dispatch, and ordnance is to be planted behind them to be ready for use. If the enemy has taken possession of the covert way, it will be necessary first to spring the mines there, in order to throw him into confusion, and then to attack him and drive him back.

Defence of the fossé. The defence of the fossé is the next most essential part; but cannot be of long duration, for if the counterscarp is lost, all is lost. Still, however, a gun, or several riflemen, will be of the greatest use to hinder the passage of the fossé; and sallies also may be made if the ditch is dry. If the fossé be wet, fire-machines will be useful to set the fascines of the enemy on fire; and where the water can be let in and out at pleasure, the enemy may be harassed for a considerable time. Even when he thinks himself master of the fossé, his works may be destroyed by a sudden inundation. The besieged always have great advantages when the enemy is among their works, as confusion is likely to take place. In such circumstances too, a sally may be successfully made.

Defence of outworks after a breach. The defence of the outworks, after the enemy has made a breach, is either attempted on the top of the breach, or from the work in its re-entering angle. In the first case, the enemy is to be attacked by small mines, artificial fire-works, and rafters thrown down upon him, care being taken that he does not overcome all these impediments, and penetrate the sections, where otherwise a good defence might have been made. As soon as the enemy has taken an outwork, and begins to construct his lodgement there, a small gun, or some riflemen, are to molest him constantly. Mines are also to be sprung under his lodgement, or any work where he has constructed a lodgement, an attack being always made upon him after every explosion.

Should an outwork be countermined, and the enemy begins a subterraneous war, he must be opposed as formerly directed.

If the enemy's well be discovered under a work, it may be filled, as we formerly observed, with poisonous smoke, and his miner be killed by grenades and shells thrown in the fossé, or by others hung before his well, and afterwards burst.

If, after the enemy has taken an outwork, he can be again dislodged, all endeavours must be used for that purpose; and to effect this, the most probable appear to be, to make a sally after bursting a mine, and to destroy his communication over the fossé.

The defence of the rampart so often neglected, though great labour is frequently used in constructing it, is the last part of the defence of a fortress. The assault here may be sustained, when a strong section is to be had, or when there is a retreat to a place, where the garrison may wait till a convention be concluded, or succours arrive. Sometimes, however, circumstances do not allow the garrison to wait an assault, and, in this case, the commandant capitulates, either to save the lives of many, or to prevent the inhabitants from being plundered. When the defence of the rampart is resolved on, the same rules are to be observed as in the defence of outworks.

Defence against the assault.

Circumstances must determine whether the enemy is to be opposed in the breach, or attacked from the section. The latter is to be preferred, unless there is every reason to believe that the former will prove successful. A sally at the time of the assault may sometimes be useful; but is always in such circumstances to be undertaken with caution.

Defence of the citadel.

A fortress with a citadel may be defended as long as possible; and when the enemy has penetrated by an assault, and when every thing necessary has been sent into the citadel, the troops are to withdraw to it, taking care that the enemy does not enter along with them. Rather than run any risk of this, indeed, part of the garrison is to be shut out. If the commandant is at last convinced that the fortress must surrender, he orders the chamade to be beaten on the attacked front, or he sends an officer to the enemy, to propose an armistice. If this be granted, he sends some intelligent officers to the enemy to conclude a capitulation, or the capitulation may be concluded in the town, the enemy sending two or more officers, with proper powers and instructions for that purpose.

rticles of pitulation.

The garrison on capitulating, either has a free retreat, and immediately marches out, or it leaves the fortress and surrenders on the glacis, either as prisoners of war, or under an engagement not to serve against the country of the besieger or his allies during a certain time. The officers and men generally keep their luggage, and the former also their swords. The place to which they shall be conducted, how they shall be paid, and when exchanged, are all agreed upon in the articles of capitulation.

The prisoners of war and the deserters are, if possible, kept; but are also sometimes delivered up to the enemy. The magazines are either emptied and destroyed, or delivered up. The works of the fortress, and the keys of all places, are given up. One gate is generally placed in the hands of the besiegers at the time of the ratification; but no person is allowed to pass who is not provided with a proper passport. The garrison has to leave the town on a certain day. All points which may not be well explained, are to be construed to the advantage of the garrison. A citadel near a town makes sometimes an alteration in the articles; as if the town is given up, the citadel is always retained. Sometimes it is stipulated, that if, during a certain time, no relief arrives, the articles of the capitulation are to be fulfilled. But the most advantageous points and articles are generally proposed to the enemy, and adhered to as long as possible; and therefore every commandant ought to be prepared with articles of this kind adapted to his case; for the sending copies of articles of capitulation for approval or rejection at the close of a siege, is merely done with the hope of gaining time. The enemy will always return an answer, and by this it may be known what articles are to be expected.

To see the terms of the capitulation carried into effect, two officers of high rank are given as hostages, who are set at liberty as soon as the capitulation is fulfilled. The non-execution of any of the articles of capitulation on either side, will only cause reprisals, and these frequently are attended with bad consequences. To prevent this, every thing is determined as minutely as possible, and all articles are then strictly fulfilled.

Methods of forcing the enemy to raise the siege.

Various methods may be employed, and in some cases successfully, for obliging the enemy to raise the siege, particularly if the garrison acts in conjunction with an army. The army may in these circumstances either attack the enemy, or cut off his provisions and succours, which seldom fail in forcing him to raise the siege. The army may also attack either the besieging army, or the corps of observation; but this should always be done with the knowledge of the garrison, in order that it may act in concert.

Sometimes a siege may be raised by the exertions of the garrison alone, as by sallies judiciously conducted, and mines well applied; but by whatever means this may be effected, the garrison ought to make sallies during the night in which the besieger withdraws his ordnance, for the purpose of annoying him as much as possible.

Defence against tirailleurs.

Should a fortress be attacked by *tirailleurs*, as was explained in enumerating the different modes of attacking a fortress, the best defence will be made by small guns placed in the most saliant parts of the works for firing grape shot. Riflemen will also be advantageously employed in attacking them, in the same manner as they attack the fortress. When, however, whole troops of the enemy's men are perceived, guns of a small calibre, charged with grape shot, are chiefly to be depended upon. In other respects, the defence is the same as has been already described.

SECT. II.

On the Attack and Defence of Field Fortifications.

Arrangement of troops in field works.

The attack and defence of field fortifications, is neither so difficult nor so tedious as that of fortresses.

The arrangement of a whole fortified line is as follows: The camp is generally about 400 paces from the lines. The works are usually occupied two men deep, or with two rows of soldiers; the reserve is placed about 100 paces behind it, in order to give support wherever it may be required; and each battery, as well as each squadron and battalion, has its particular place assigned to it. As soon as the alarm-gun is fired, each man must repair to his post as speedily as possible, completely armed, and ready to act.

Outposts, &c.

To secure the fortifications from a surprise, the light infantry posts are about 5000 paces before the works. If, however, the country is inclosed, or woods are near them, the chain of these posts is thicker, viz. about from 500 to 2000 paces distant from the works. Among these posts constant patroles are sent round. If the enemy be close to the works, at least one-half of these posts must always be under arms. During the day, the same is to be observed by all the outposts, and sometimes also by all the men in a camp. The arrival of the enemy is generally known, as in the case of fortresses, from deserters, spies, &c. When the enemy approaches, the outposts are to engage him, and to keep him as long as possible at a distance, that the troops may have time to form. The works are then quickly occupied, the artillerymen having previously made themselves acquainted with the distances before the works, that they may level their guns accordingly. The guns in the saliant angles begin their fire as soon as the enemy is within reach. If a few guns, by advancing, can take a part of the enemy's force in flank, it will be of great consequence. The infantry begin their fire when the enemy is at about 300 paces distant. As soon as he comes sufficiently near the works, the guns are to be dismounted, and their places filled up by infantry. But if he should advance to the ditch, artificial fire-works are made use of; and if he ascends the parapet, a brisk fire must be kept up, followed by a charge with the bayonet, and the first rank standing upon the parapet. Should the enemy have penetrated in any part, the cavalry are to charge him before he forms. The reserve must now pay the greatest attention; and the horse artillery, as soon as the enemy has penetrated, will be of great use in throwing him into disorder, of which the cavalry must take advantage. In the mean time, the infantry forms, and returns to the attack. If the enemy should be compelled to retreat, he is not to be pursued too hastily, lest, by rallying, he should succeed in entering the interior intrenchments along with the troops that retreat thither; but the ordnance must at this moment play upon the enemy with all possible vigour.

Defence of single forts.

The defence of single forts is almost the same as above mentioned, except that the garrisons have to encamp in their respective forts; and that the single forts are supported by the ordnance as well as by the infantry, both being drawn up in line behind them. The artillery is brought wherever the principal attack is made, and must be employed with the utmost effect. Should the enemy be repulsed, or be thrown into disorder at any point, the cavalry suddenly advances, charges directly, and pursues, but always keeps closed, and in good order.

If the attack of the enemy should be undertaken in the night, then the country round the fortifications is illuminated by light-balls or by fires, for which purpose wood must previously have been brought thither.

The troops should always be acquainted with what they have to expect from the works, and how they can turn them to the best account in their defence. The moment of the attack is intimated to them, as also the danger to which they will be exposed if they should be defeated; and, on the contrary, how much they will gain if victorious. Convince a soldier that his honour is at stake, and the work which he is to defend will be easily fortified.

False alarms, &c.

To keep the men always on the alert, a false alarm may sometimes be given; but care must be taken that this is not too frequently resorted to, lest they neglect to be prepared when a real attack is made.

Attack of fortified lines.

The attack of fortified lines should not be undertaken before an accurate knowledge has been procured of the works which the enemy has constructed to oppose it. The attack, as before observed, is most advantageously made an hour before day-break. The fortifications should, if possible, be taken in rear, by going round them, which may be most favourably done by a night-march, provided there be no danger of mistaking the road, which might lead to great confusion, and disastrous consequences.

Order of the attack.

Each attack is to be made in a column. The first are the grenadiers or volunteers; then a number of armed workmen, with shovels, fascines, woolsacks, ladders, &c. for filling up the fossé, and ascending the parapet. After the workmen, follow a number of infantry to second the grenadiers, and then a sufficient number of cavalry and artillery to support the whole. Besides the real attack, a feigned one is generally undertaken to mislead the enemy. This attack, however, must never be too weak, that it may follow up its success with sufficient force. The wings being generally the weakest points, are usually attacked at the same time, in order, as much as possible, to disperse the enemy. Should an attack be supported by ordnance, it must be superior in force to that of the enemy. If it be an open attack, the light guns always advance with the attack, and fire. The attack may in this case be made *en echellon*. As soon as arrived on the counterscarpe, the grenadiers commence their fire, while the workmen fill the fossé, and make it practicable. As soon as the grenadiers commence the assault, and collect in the fossé, the infantry also begin their fire from the counterscarpe. After the fossé is passed, the impediments in the berm are removed, and the parapet is assaulted at once. If the assault be successful, the cavalry and more infantry directly follow, and form behind the parapet, to attack the enemy wherever he appears, and to increase the disorder caused by the flying troops. The guns of the fortifications are now directed towards the enemy, always taking care that order be preserved, and room made for a large force to penetrate, and attack with more vigour.

Assault.

Attack of detached works.

Should detached works be attacked, there should be as many columns of attack as there are works to be attacked. All these columns are connected by infantry. At least so many works are to be attacked, that the troops employed to attack one work may have little or nothing to fear from the neighbouring works. The cavalry advance whenever the grenadiers begin the assault. As soon as the redoubts or works are taken, the infantry also advances, supported by the ordnance; the second line of the army remaining about 300 paces back, to cover the retreat, if necessary.

Should artillery support the attack, it advances to within about 100 paces of the works, where it stops, and opens on the enemy's troops, the cavalry at the same time charging wherever disorder is perceived in the enemy's army.

If it be thought necessary that the fortifications be cannonaded before the attack is undertaken, it may be done the day previous to the attack; but no time should be left for the enemy to repair the works before the attack is made.

Attack of single

The attack and defence of single forts are conducted in the same manner; and the saliant angles are always chosen as the weakest points. Any single fort, however, is always to be taken by surprise, if possible, which is to be executed during the night. An open attack is always supported by ordnance, and commences only after sufficient breaches or openings have been made in the enemy's works.

Vigilance, some outposts, and frequent patroles, are the best defence against a surprize; but if it is expected, one half of the men must always be under arms.

Attack of fortifica- tions on ri- vers.

Fortifications situated on rivers may be attacked as described above, but what relates to the manœuvres and previous movements, will with greater propriety be introduced under the article TACTICS. A house or a small estate is most advantageously attacked by an howitzer or a piece of ordnance, as if struck by a single shell, it will be forced to surrender. If such a house has no flanking defence, it may sometimes be set

Attack and Defence of Field Fortifications.

on fire. Perhaps a secret entrance, or ladders, may be of use, and are to be applied if circumstances will permit. The defence of such a house may sometimes be kept up very long. Even if the enemy has penetrated one part, he may be again repulsed if not very strong, or if his succours do not arrive in time.

Attack and defence of villages,

An estate, or a church-yard, which has been fortified, may always be advantageously attacked by guns; and after an opening has been made, it may be carried by assault. The defence of a fortified village requires more circumspection. All passages to it are to be taken possession of, and sufficient posts and patroles are sent out, to prevent a surprise. All works are to be occupied only by detachments; and the reserve must be near the principal work, or stationed at such a place, that it may easily afford succour to any part. As soon as an alarm is given, all the works are properly occupied, and succours sent if necessary. The side of attack is to be discovered if possible, and particularly strengthened; but other fronts are also not to be neglected. To prevent the force from being too much dispersed, it will therefore always be advisable not to occupy too large a circumference, but rather to be content with the defence of a strong post by a concentrated force. The attack of a village is generally made in two or more parts, one being the real and the other a feigned attack. But before it is undertaken, every proper and necessary information respecting the works should be procured, either by spies, or by reconnoitring.

The infantry penetrates first, and are immediately followed by the cavalry. This attack is in every respect the same as that of camps, already explained.

l small ns.

The defence of a country town may sometimes be kept up for a considerable time. As soon as its defence is resolved upon, a general place of alarm is chosen, all the streets are ordered to be illuminated if the alarm is given at night, and no inhabitant is to appear at that time. The posts, guards, and sentinels, must be attentive, and patroles are also to be sent round the town. In the day-time, posts are placed before the gates at greater distances. No gates towards the country should be opened at night, until there has been a close examination and proper lights, lest the enemy should attempt a surprise; and never should more than one man be allowed to enter at a time. If necessary, the inhabitants are to be disarmed. The soldiers are to be quartered in such a manner, that each may soon repair to his post, and to such works as he has to defend.

To prevent the enemy from approaching secretly, the surrounding country is to be surveyed, and every thing that may favour his approach is to be levelled. The gates should be barricadoed, and every one who goes out or enters must be known by an inhabitant, who must be made answerable for his conduct. No assemblages of people are allowed, and particularly near the gates. If the enemy advances to the attack, no fire is to be opened upon him till it can be done with effect. Should he penetrate at any part, a force must immediately be collected to oppose him, taking care always that a retreat be secured, even though a capitulation should be the consequence. The most advantageous mode of attack is by surprise, which is to be effected in the same way as the surprise of a fortress. The same applies to towns, and indeed to fortified places of all kinds.

When a town is set on fire, the inhabitants usually intreat or compel the commandant to surrender.

Should the enemy undertake a sortie, or if a gate can by any means be penetrated, it will hasten the surrender of the town. In all cases, however, the retreat of the enemy is if possible to be cut off.

Attack and Defence of Field Fortifications.

A most advantageous attack of such a town is made by tirailleurs, in the same manner as has been explained in the Section on the Attack of Permanent Fortifications.

Sketch of Carnot's *Method of Defending Fortified Places.*

From the account which we have now given of the attack and defence of fortified places, the reader must have observed, that when a fortress is regularly invested, however strong it may be, its fall after a certain period is considered as a matter of course. The maximum of that period we formerly stated at 90 days. In the actual state of things, however, it seldom exceeds the half of that, and even this is considered a good defence. In proof of these remarks, we subjoin the calculation which Vauban gives of the duration of a siege, supposing the place to be strongly fortified and well garrisoned.

Duration of a siege according to Vauban.

	Days.
From the investment of the place till the opening of the trenches	9
From the opening of the trenches till the attack of the covered way	9
The attack and capture of the covered way . .	4
Passage of the fossé of the demi-lune	3
Making a practicable breach in the ravelin . .	4
Taking the reduit of the ravelin	3
Passage of the great ditch commencing before the ravelin was taken	4
Making a practicable breach in the place . . .	4
Defence of the breaches	2
Surrender of the place after capitulation . . .	2
Negligence and errors of the enemy	4
Total . . .	48

We have already observed, that the application of such calculations to the operations of moral causes, may perhaps at first sight appear absurd. It is to be remembered, however, that from the superior force which the besiegers can always command, it is impossible that any place can hold out for an indefinite period. It seems reasonable, therefore, that certain laws should be established among nations with regard to the surrender of fortified places, in order to prevent the obstinacy of an individual being the cause of an unnecessary effusion of human blood. Such laws have accordingly been generally recognised, and those who persevere in their defence of a place, after it ought by these laws to surrender, are considered as having deprived themselves of the privileges usually granted to prisoners of war. A modern writer on fortification, M. now Count Carnot, has, however, advanced a very different doctrine. Reasoning on that fundamental principle of military discipline, that every soldier ought to die rather than give up his post, he maintains, that such calculations as we have detailed above, are generally false, and that, when they are true, they tend only to crush the spirits and paralyze the efforts of the defenders. He considers the courage and determined perseverance of the garrison as the strongest bulwark, and therefore condemns every thing that tends in the slightest degree to depress or extinguish these. Such reasoning, however, would scarcely be entitled to notice, and certainly would never contribute, in any essential degree,

Laws recognised by nations in the surrender of fortified places, founded on the above calculations.

Carnot rejects these calculations.

to prolong the defence of a place, unless it were accompanied with something more substantial than mere declamation. To support his arguments, therefore, Carnot has proposed a new system of defence, against which he considers the present method of attack altogether inefficient. Admitting what, indeed, cannot be denied, that if the besiegers are permitted to proceed step by step with their approaches and parallels, as in the ordinary way, the guns of the fortress will soon be silenced, and the fall of the place must follow; he sets out with shewing how the progress of the enemy is to be retarded. This is principally to be done by irregular sorties, so contrived, that the sallying force may always be greater than the force to be attacked. The sallies commonly made in the present system of defence are too regular to be effectual. They are always made at the same points, where, of course, the enemy is always prepared to receive them; so that, before they can succeed in destroying any of the works, they must combat a superior force. But by contriving to have a great number of points from which sorties can be made, the garrison may have frequent opportunities of attacking an inferior force, so as to insure success in destroying the works intended, without sustaining any considerable loss. By these, frequently repeated, the enemy's progress is retarded, his troops are harassed, and he is obliged to employ a much greater number in defending his workmen, as it is only by a very strong guard at every possible point of attack, that he can protect his entrenchments from the disastrous effects of these sorties. But even should he have men enough to form sufficient guards on every part of his works, by crowding great numbers into one place, he only exposes them to a more certain destruction, from the immense number of vertical fires (*feux verticaux*), which form the second, and indeed the principal part, of Carnot's method of defence. These consist of mortars of different calibres, elevated at an angle of about 45 degrees behind the parapet, and covered by blindages. In this way, the guns themselves, as well as the men who work them, are completely protected, both from the direct and ricochet fire of the enemy. When used, they are loaded with a charge sufficient to carry the shot to such a height, as that, by its descent, it shall acquire velocity enough to prove fatal to the person whom it may strike. Of the effect produced by these vertical fires, when substituted for the greater part of horizontal guns, in a garrison of an ordinary size and strength, Carnot gives the following calculation.

Proposes a new system of defence by irregular sorties, and vertical fires.

Commencement of the vertical fire.

The vertical fires are supposed to commence only when the enemy opens his third parallel, as the distance previous to this would render their effects less certain. From this period till the opening of the breaches, the usual calculations allow 10 days; and the effects of the vertical fires during these 10 days may be found thus.

Space occupied by the besiegers.

Supposing the third parallel to be 100 yards from the flanked angles of the bastion and of the ravelin, and the length of the exterior side of the polygon 360 yards, the field occupied by the besieging army will be nearly 36,000 square yards; but, in order to calculate on the *minimum* effect of the fire, call it 60,000 yards.

It is now necessary to ascertain how much of this space is actually covered by the bodies of the men who act as labourers and guards of the besiegers works. The number of these men is generally estimated at three-fourths of the garrison, a smaller proportion being found too weak for resisting the sallies of the besieged. Supposing then that the garrison consists only of 4000, the guard of the trenches will be at least 3000, that is, 3000 men will be spread over the surface of the ground forming the avenues of the place; but these avenues, it has been shewn, are contained within a space of 60,000 square yards, therefore the number of the besiegers occupying the avenues or passages, will be one-twentieth of the square yards, that is in the proportion of one man to 20 square yards.

Number contained in that space.

Space occupied by the bodies of the besiegers.

Let it now be supposed that a man's body projected horizontally covers one square foot, and nine men will thus be required to cover completely a square yard. But it has already been calculated that there is one man in every 20 yards of the space occupied by the besiegers, therefore the space actually covered by the bodies of the enemy's troops and workmen, will be the 180th of the whole; and, consequently, out of every 180 shots falling in an inclined or parabolic line within that space, one, in the course of a long continued fire, will strike the enemy. It is to be observed, however, that this is the minimum, or least possible effect to be expected from such a fire, because all the data on which the preceding estimate is founded, have been assumed on the most unfavourable suppositions. The enemy has been supposed equally distributed over all the space, instead of being very much concentrated, as they really are on the glacis, towards the capitals of the saliant angles, to which the vertical fire may also be readily confined. A man's body, too, has been supposed to cover only one square foot when horizontally projected; but if he is working or marching, which must be the case with the greater part of the besiegers, it will occupy a much larger space; besides, as the line described by the shot is not perpendicular, but inclined, the surface presented to it by a man's body, must be double his horizontal projection. All these circumstances considered, it would not, perhaps, be too much to suppose that one ball in 50 takes effect; but to prevent every possible objection on this score, let it be supposed, as above, that one ball in 180 proves fatal to one of the besiegers.

Let it be supposed, in the next place, that there are mounted on the attacked front, six twelve-inch mortars, two on each of the bastions, and two on the ravelin, so situated as to fire along the capital of each. The mortars, as formerly observed, are protected from the direct fire of the enemy by the parapet, and from the ricochets by a shell-proof covering, having only one opening sufficient to allow the escape of the shot at an angle of 45°. The side towards the place may be open to prevent the collection of smoke, and surrounded with a small fossé to secure it from the shells that may fall near it.

To estimate the effect of each piece then, it is to be observed, that as the shell of a twelve-inch mortar weighs 150 pounds, the same weight of balls, each a quarter of a pound, may be fired with the same charge, that is, each mortar, at a single shot, will discharge 600 such balls, being 3600 from the whole. But it has been shewn, that out of 180 balls, one may be supposed to strike the enemy; therefore at each discharge of the six mortars, twenty of the besiegers will be put *hors de combat*.

It remains now to inquire how many rounds may be fired in the space of 24 hours, the fire being continued during the night as well as the day. These, at a moderate calculation, may be rated at 100, which allows nearly a quarter of an hour to each round. But as every discharge 20 of the besiegers are disabled; therefore in 24 hours, 2000 men will be destroyed or ren-

Effect in ten days.

dered unfit for duty. In the course of the ten days then, between the opening of the third parallel and effecting a breach in the rampart, the besiegers will sustain a loss of 20,000 men. But if the garrison consist only of 4000, the whole of the besieging army will probably not exceed 20,000, being in the proportion of five to one, that is to say, the besieging army will be completely destroyed before it is able to effect a breach. If the garrison were stronger, and of course the besiegers more numerous, it may be shown, by a similar calculation, that their loss would be proportionally great; or in general, that a garrison of any strength may, by means of a vertical fire alone, destroy five times its own numbers, in the space of ten days after the opening of the third parallel.

Advantages of the system in point of economy.

From the above calculation, Carnot concludes, that no fortified place, whatever be its size, if defended in this way, can be taken by any method of attack presently in use. Nor is the certain destruction of the besieging force the only advantage of this new method. Economy, both in men and money, is another and a powerful recommendation in favour of the system. The garrison is neither exposed to danger, nor harassed by a laborious defence. A few companies of artillerymen are *alone* requisite, who can carry on their operations without any danger from the enemy's fire, and without any interruption from dismounted guns, or broken carriages. The great bulk of the garrison have nothing to do but watch the most favourable moment for making a sortie; and by thus obliging the besiegers to keep strong guards on their works, they render the vertical fire more effective. It has already been shewn what execution may be done by six mortars alone; and from this it may easily be calculated what any greater number might effect in a given time. It is not necessary that all the mortars should be of the same size, nor that they should be all planted in the same places. They may be of various calibres, and mounted on different parts of the works, according to the distance of the besiegers. It is obvious, however, that, at a given expence, more execution may be done by such mortars, than by artillery of the common sort. As the charge is in general small, perhaps cast iron balls might be strong enough to resist the shock, without breaking, which would of course diminish the expence still more. But even though it were found that these did not answer, bars of iron, which are used for many other purposes during a siege, by being cut into pieces of about an inch in length, might be used instead of balls; and if the garrison were supplied with a great number of large mortars or swivels, even this expence might be saved by loading them with stones. The number of stones discharged from a single mortar at once would not be indeed above one-tenth of the iron balls; because stones, to produce the same effect, must be so many times larger. But if the number of mortars were ten times greater, the total effect would be the same.

Having stated some of the advantages of his system, Carnot proceeds to shew, that it is only by adopting it that the balance between the modern systems of attack and defence can be turned in favour of the latter. The duration of a siege, he observes, scarcely ever extends to six or seven weeks, and, in most cases, does not exceed twenty-two or twenty-three days. Of these, fourteen are generally occupied in constructing the approaches; so that the actual attack on the place is reduced to eight or nine days. The cause of this very limited period of defence is to be ascribed, he thinks, partly to the impossibility, in the present system of defence, of mounting artillery, so as not to be very soon silenced, and partly to the want of such a method of firing as can reach the besiegers behind their intrenchments. Both of these *desiderata* are supplied by his method, which he then proceeds to vindicate from some objections that have been started against it. These objections are as follow:

Objections.

1*st*, That the balls recommended are not large enough to produce the desired effect.

2*d*, That the besiegers would avoid the fall of the shot, by keeping out of their reach; and,

3*d*, That the method recommended would consume a great deal of iron.

Replies.

In answer to the first objection, he observes, that there is nothing unreasonable in supposing that a square piece of iron, of the size of a pigeon's egg, should, in descending through 120 feet, acquire velocity sufficient to kill a man. But should this be questioned, he appeals to the example of the ancients, who with their slings, which carried to a much less distance than modern swivels, and with balls much lighter, easily killed or maimed their enemies.

To the second objection he replies, that it can only be worthy of refutation, when it has been shewn that a besieging army may take a place without approaching it. And,

On the third, he remarks, that for the very same reason a garrison should not use artillery of the common kind, because it will consume a great quantity of lead. But the force of the objection is still more completely removed, when it is remembered that stones may be substituted in the place of metal balls.

The ingenious author is not satisfied with replying to objections that have actually been made against his system;—he also anticipates others that might be advanced. He observes in particular, that it would be impossible for the besiegers to approach the place under the protection of blindages, because it would be impossible for them to find either time or materials for the construction of such works; and even if they could, the slightest sortie from the garrison would throw them into confusion, and destroy in a moment the fruits of their long labour.

Advantage of the system in resisting an assault.

But it is not only before a breach has been made that this new system of defence can be employed. It is equally effectual in resisting an assault, provided there be an interior intrenchment between the rampart and the place, when a few mortars have been mounted, and reserved for the moment of the attack. At this moment, the garrison is to retire from the breach, and the mortars of the retrenchment are to open at once with a discharge of balls or stones. The consequence of this must be total destruction, or at least immense loss, to the breaching party. Should any of them in the mean time gain a footing on the rampart, they must be in great confusion, and may therefore be easily dislodged with the bayonet, the garrison taking care to attack them the moment the fire ceases.

Comparison of Carnot's with the old system.

Such is a short outline of the system of defence proposed by one who appears to have devoted the efforts of a powerful mind, and the labours of a long life, to the improvement of a science interesting above all others to his country, but which military men, in general, have been too ready to regard as incapable of farther improvement. In comparing this system with what is still commonly practised, it is impossible to avoid being struck with the radical difference in the principles on which they are founded. In the old method, the garrison acts almost solely on the defensive; it waits the advance of the besiegers, and is obliged to sustain the heaviest shock after half its means of defence have been destroyed; but in Carnot's method, the garrison, by a combination of sortees and vertical fires, is constantly acting on the offensive. By the one it cuts off weak parties, and destroys their works, and by the other it assails the strongest force with a certainty of success unknown to every other species of artillery. In a word, it puts into the power of the defenders all the advantages that have been for so long a time exclusively possessed by the besiegers, both in offensive and defensive operations.

Various kinds of projectiles recommended by Carnot.

In enumerating the various kinds of projectiles that may be used in defending a place, Carnot also recommends common artillery in certain circumstances, but thinks they should not be fired through embrasures, at least if they are mounted on the faces. Instead of these he proposes temporary merlons, consisting of bags of earth, to be used till the enemy opens his ricochett batteries, after which the artillery is to be withdrawn. *Grenades*, he thinks, might also be used with great advantage, and even in some cases the *manubalista* and *scorpion* of the ancients. There is still another kind of artillery, however, which, from its singularity, merits attention. It was first suggested by M. Flachon de la Jomarière, and consists in discharging an immense quantity of water by means of pumps on the works erected by the enemy on the crest of the covert way. By this means Jomarière supposed that the earth would be so completely soaked, as to put a stop to their work. "It would not be difficult to conceive," says Carnot, "that this idea was every where turned into ridicule. It was however decreed by government, in 1785, to put the plan to the test of experiment, and that experiment, to the utter confusion of the sarcasm makers, completely succeeded. The sappers could no longer fill their baskets; the earth was converted into a liquid mud, which slipped from under them, and of which it was impossible to construct any intrenchment. Yet, notwithstanding all this, the experiment has never been followed up;—a proof that it is not always sufficient to have experience, reason, and even the good of the state on one's side—the inertia of indolence may resist all these. Perhaps an age or two hence, some extraordinary events may shew, that the idea is neither extravagant nor absurd." We should not be surprised if the sentiments which Carnot has expressed with regard to Jomarière's plan of defence, are hereafter found to be strictly applicable to his own.

Defects of the present system of defence.

As might be expected from what has been already stated, the present construction of fortifications is, in the opinion of Carnot, extremely defective. Of these defects he has given an enumeration, and has also illustrated them at considerable length.—They are as follows:—

1*st*, There is no provision made for covering either the artillery, or the garrison on duty, from the fire of the enemy. In consequence of this, the guns of the fortress are generally dismounted in a few days.

2*d*, There is no interior work or intrenchment, so that whenever the besiegers make a successful assault, the place is in their power, and the inhabitants exposed to pillage.

3*d*, The communication between the different parts of the place and the outworks, is too difficult for the prompt execution of any necessary movement. As an improvement in this respect, Carnot proposes, that instead of a wall in the counterscarpe, there should be a gentle slope or glacis, from the covert way to the bottom of the fossé, so that if the besiegers should get possession of the former, the besieged might make an attack upon them at any point, where they had the greatest prospect of success. Should it be objected to this construction that it would enable the enemy to advance without interruption to the bottom of the enceinte, Carnot justly observes, that it is not advancing thither, but establishing themselves there, that is to be dreaded; and this they would not easily do without immense loss from the fire of the place.

4*th*, The covered way is not constructed so as to answer the purposes for which it is intended. These are, 1. To collect the force that may be sent to the assistance of the place. 2. To form the troops intended for a sortie. 3. To serve as advanced posts for preventing surprises. 4. To cover by its parapet the revetement of the works: And, 5. To furnish a second line of fire to the enceinte. On the first of these our author observes, that the covert way being hid by a pallisade towards the field, it is a matter of great difficulty for the auxiliary troops to find out the point where they can enter it, and even after they have entered it, if they consist of cavalry or artillery, it is equally difficult to find admittance into the place. For the same reason it obstructs, rather than assists, a sortie, particularly if the sallying force consists of cavalry. As to preventing surprises, it is, in its present form, of very little use, as the besiegers can, in a few minutes, make their way over the pallisade, by means of their fascines, and that too with scarcely any noise. In covering the revetement of the works, it might be useful, if its parapet were higher than the revetement; but it is well known that, in the greater part of modern fortifications, this is not the case; and, with regard to its affording an additional line of fire, it is obvious that, as the besiegers are always covered by a parapet, the rasing fire which the covered way affords can be of little value. Many of these disadvantages would be avoided, by substituting a glacis for a revetted counterscarpe, as already described.

5*th*, In the present construction of fortified places, the ravelin does not completely cover the shoulders of the bastion, so that the enemy can reach them with his fire through the openings of the tenaille.

6*th*, The escarpe is too much exposed.

7*th*, There is no means of having a fire directed along the capitals of the saliants, on which the enemy's approaches are generally constructed.

8*th*, The fall of the revetement at the time of the breach, generally drags with it the whole of the parapet, which greatly facilitates the assault of the enemy. This might be remedied by having a way of rounds, though that too has its inconveniences.

9*th*, The masonry of the works, on account of their talud or slope, is easily worn down by the action of the weather.

10*th*, The place, in general, is not furnished with sufficient souterrains for protecting the men and the ammunition.

11*th*, The present system of defence requires a much greater quantity of wood than can in most cases be procured: And,

12*th*, It exposes the soldiers to severe and incessant labour, without the possibility of their obtaining necessary repose.

The great length to which this article has already extended, prevents us entering so largely, as we should otherwise have done, on the system which we have now endeavoured to sketch. From the preceding observations, however, our readers will readily perceive, that the work is not unworthy of its distinguished author, and that the principle which it unfolds is peculiarly deserving the attention of engineers.

See Vauban, *Traité de l'Attaque des Places.* Carnot *De la Defense des Places Fortes*, Paris, 1812, &c.

See Military Architecture for the subject of Castrametation, and other topics connected with the preceding article.

FORTS, Vitrified. The appellation *Vitrified Forts*, has been given to certain melted or vitrified masses of stone, which were discovered on the tops of some hills in the north of Scotland, about the year 1773 or 1774, by Mr Williams, a mineral surveyor, who published an account of them in the year 1777.

For a considerable time, they engaged the attention of some of the first literary characters, and gave exercise to the ingenuity of antiquarians. Various conjectures and theories were announced; and some went so far as to conclude, that nothing short of volcanic fire had produced the vitrifications. Whether it has been owing to an idea, that their origin was involved in impenetrable obscurity, or that there seemed to be no prospect of the learned world coming to an agreement of opinion, it is certain, that a very long time has elapsed since this field of research has been abandoned, and curiosity apparently been asleep. Happily, the spirit of inquiry is now more widely diffused, and less easily damped; and we shall consider ourselves fortunate, if the brief notices in the present article shall lead to a more general and accurate examination of the appearances under review, than has hitherto been bestowed upon them. Mr Tytler (the late Lord Woodhouselee) has very justly remarked, (in a memoir written on this subject about thirty years ago, and published in the Transactions of the Royal Society of Edinburgh,) 'how curious it is, that the same appearances to different observers, lead to the most opposite opinions and *conclusions!*' This clashing of opinions may sometimes be owing to the different degrees of attention which have been bestowed on the facts, and their relative connections. It sometimes happens too, when a person has formed a theory, that he is very apt to view every thing with an eye, which sees only what accords with his own fancy, to the entire exclusion of the views of others. But circumstances of importance often escape the most accurate observers, and lie concealed till accident leads to their discovery, or till unbiassed observers remove the exaggerations, occasioned by fondness for a new discovery, or by attachment to a new theory.

It appears to us that, whatever may have been the cause which discovered to the inhabitants of the country the vitrifiable nature of the stones, of which we find the structures in question composed, or suggested the application (if ever it was made) of this discovery to any useful purpose, some confusion has arisen in the attempts to account for the present appearance of the vitrified masses, from the want of means to trace their first origin. It has fallen to our lot to discover such means; and having been so fortunate, we have some hope of being able to reconcile many opinions which at present seem to be very opposite, and to open a path which may lead to the truth. For thi purpose, we shall begin by describing the facts which presented themselves to our view, while examining the top of the hill of Dun Creich in Sutherlandshire, where, we think, the true origin of the vitrifications, which have occasioned so much speculation, has been found. We trust that it will appear evident, that *making signals by means of fire* has occasioned not only the appearances in Dun Creich, but those on many other hills, and has probably been the origin of this singular method of cementing stones, if indeed it was ever resorted to for purposes of architecture.

Near Creich, in the county of Sutherland, a ridge projects into the Frith of Dornoch, terminating in an abrupt precipitous hill. This ridge lies nearly east and west; and from the summit there is an extensive view of the sea, and the country towards the east; and of the valley, containing the Dornoch Firth towards the west. The access to the top is by no means easy, even where it is most practicable. Round the edge of the summit there is a rampart of loose stones, marked on the plan (Plate CCLX. Fig. 1.) by the letter R. A, marks the site of the remains of a building constructed of stone and lime. It is about thirty feet square, the walls being three feet thick, but not now more than four feet high. On the outside of this building, as marked by the letter B, is another rampart of loose stones, which is probably the remains of a structure intended for the same use, but which has been exchanged for the more substantial and convenient building within. C is a well, which has been filled up. There is a very good spring of water on the outside of the rampart, on the south side of the hill. D marks a line, on which there is a mass of stones bearing abundantly the marks of fire, and which we traced across the whole summit. The surface of the hill within the outer rampart is uneven and rocky; and that part of it which is crossed by the vitrified mass, is rather lower than the eastern portion.

Plate CCLX. Fig. 1.

The line D being the only one which is vitrified, no marks of fire appearing any where else, is a striking and important fact. This line extends from A to B on the sketch (Fig. 3), passing over the top of the hill, and in the only direction in which a range of signals could be made, so as to be distinctly seen further up the country.

Fig. 3.

To be satisfied of the reason why the signal fires should be kindled on, or beside a heap of stones, we have only to imagine a gale of wind to have arisen when a fire was kindled on the bare ground. The fuel would be blown about and dispersed, to the great annoyance of those who attended. The plan for obviating the inconvenience thus occasioned, which would occur most naturally and readily, would be to raise a heap of stones, on either side of which the fuel might be placed to windward. To account for a large extent of vitrified matter, such as that along the line D, it is only necessary to allow the inhabitants of the country to have had a system of signals. A fire at one end, might denote something different from a fire at the other, or in any intermediate part. On some occasions, two or more fires might be necessary, and sometimes a fire along the whole line.

It is evident, that the people who formed the structure on Dun Creich, had no idea of applying fire for the purpose of strengthening the ramparts, and had not even taken the hint afforded them by the effects of the signal fires. Hence we consider the appearances at this place as demonstrative of the fact, that the vitrifications have been occasioned by the lighting of signal fires, to warn the inhabitants of the approach of an enemy, or to convey the orders of a chieftain to his dependants. It appears too, that such signals have been common after the use of lime mortar was known, since we find on this hill the remains of a building constructed with it. This may have served the double purpose of a watch tower, and the habitation of the people who had charge of the station. At the head of the valley are the remains of an old castle, with which the station was probably connected. While on the top of Dun Creich, it occurred to us, that marks of fire would be found on a hill, which obstructed the view of Dun Creich from Strath Carron, a valley which branches from that of the Dornoch Firth. We went to the spot, and found several masses of melted stones. A few miles up Strath Carron, where a steep rock occupies an angle formed by the river Carron and a tributary stream, are the remains of a fort, built in the circular form of the Duns, (or Danish, or Pictish forts, as they have been called,) with distinct traces of ditches and earthen ramparts in front. With this also, the signal station of Dun Creich may have been connected.

We believe that nothing similar to Dun Creich, or other vitrified forts, has been observed farther to the northward; though it is probable something of the sort may exist at the head of other firths. The next we shall take notice of is the first we meet with to the southward, and is situate at the head of the Cromarty Firth. The name of the hill is *Knock Farril,* and it is one of those which arrested the attention of Mr Williams. It is about two miles from the town of Dingwall, in the county of Ross, and forms part of a double ridge, which bounds the valley of Strathpeffer on the south, and separates it from the valley of the river Conan. The ascent from the east and west ends is comparatively easy, but the sides of the hill are very steep. From the summit there is an extensive view of the Firth of Cromarty, and of the adjacent country; and the hill of Craig Phadrick near Inverness, on which there are vitrifications which have been described by Mr Tytler, is distinctly seen. The flat area on the top is a good deal inclined towards the west; its length being about 135 yards, and its medium breadth about 45. Round the area, and close to the edge of the hill, we find masses composed of stones cemented together by melted matter, irregular in their positions and size; and extending at each end about 50 yards from the area. The vitrification is every where superficial, extending but a very little way among the stones. There is a considerable quantity of rubbish seen in the cuts which Mr Williams caused to be made across the area in different places. This rubbish appears to have been collected for the purpose of extending or forming the area on the top; and it would seem that much labour had been bestowed in accomplishing in this manner what might, apparently, have been effected more easily by cutting down part of the summit. On the plan (Plate CCLX. Fig. 2), A, marks the cuts made by Mr Williams; B what seems to be the vestiges of a hut, and C the remains of a well, or rather a tank for holding rain water; for there is no appearance of spring water issuing from any part of the hill. The area measures nearly an English acre. This station may have been chosen to give warning of the approach of ships up the Firth of Cromarty, and was probably the signal-post of the castle of Dingwall, formerly the residence of the Earls of Ross.

PLATE CCLX. Fig. 2.

To account for the vitrification appearing all round the area, we have only to refer to our supposition of a system of signals, and the shifting of the wind rendering it necessary to change the side on which the fires were to be lighted. The vitrified masses appear in many instances to have been displaced; and one fact occurred to our notice which ascertains this displacement beyond a doubt. On searching below a mass, the vitrified side of which was considerably inclined, we observed some melted matter that had run down and consolidated in the form of stalactites. Had this mass been in its original position, these would have been perpendicular; but they were at right angles to the inclined vitrified surface. Many fortuitous circumstances may have contributed to produce the present irregular appearances. It cannot be doubted that the rampart was originally formed with as much regularity as the nature of the materials would allow, both in order to render it more durable, and to make it serve the purposes of defence. For we must believe, that so important a station as one for signals, was rendered sufficiently strong to resist the attacks of an enemy. We do not, however, consider that any appearance on Knock Farril indicates the fusibility of the stones having been used for consolidating the ramparts. Dr Anderson was mistaken when he stated, in the 6th vol. of the *Archæologia,* that the vitrifications are to be seen only on the outside of the ramparts of Knock Farril. He mentions, however, the fact, that on the hill called *Top of Noth,* in Aberdeenshire, the vitrification is only on the inside; which is a very satisfactory confirmation of the idea that it has been produced by signal fires. Had the outside of the rampart on Top of Noth been vitrified, we might have been warranted in concluding that fire had been used to strengthen it. Had the inside been vitrified with this view, it is impossible to conceive that no attempt was made to cement the outside also; since in every structure for defence, however rude, we find the strongest, and not, as in this instance, the weakest, part opposed to the approach of an enemy. On some hills, places apparently intended for defence have been found, where there are no appearances of vitrification. In such instances it is probable that the stones will be found not to be of an easily fusible nature; if in reality, no vitrification can be found, on accurate search being made. This last remark is occasioned by the discovery of a mass of vitrified stones on the hill of Dun Jardil, one of the stations along the great chain of lakes, which escaped the notice of Mr Tytler, but was found by Mr Nimmo, civil engineer, and late rector of the academy at Inverness.

The following considerations seem to support the idea of such high situations being chosen expressly for signal stations. Such hills only, as command an extensive view of the sea, or adjacent country, have been selected.

Each hill is in sight of one or more similar stations, as far as has yet been observed, with the exception of Dun Creich, which seems to have been devoted exclusively to the use of the extensive valley in which it is situate; though hereafter others may be discovered to be connected with it.

There is a regular chain from Knock Farril and Craig Phadrick, along the great valley of Lochness to the west coast; and others are in sight towards the east. So that, on the appearance of an enemy on either side of the island, the whole country from coast to coast could be informed, probably within the short space of an hour.

Such is the situation of vitrified forts exclusively; for they are not seen in any but commanding situations; while many spots more convenient, and better adapted in every respect for defence, are often to be found in their vicinity, or at no great distance.

In the statistical account of the parishes of Boleskine and Abertarf, the hill of Dunardile, or Dun Jardil, mentioned by Mr Tytler, is noticed; and it is added, "that a similar tower is in the same direction, contiguous to the house of Invergarry; and that the tradition of the country is, that those hills were watch towers for giving signals upon the approach of an enemy by large fires."

It is about seventeen years since the writer of this article suggested to several persons whom he accompanied in their visits to Knock Farril, which is near his country residence, the idea of vitrified forts having been signal stations; but this he believes was not new, though he had not before seen or heard it stated. The opinions which were at that time entertained, were, that fire had been used for the purpose of cementing the walls, by fusing the materials of which they were composed; and that the vitrifications had been caused, not in the erection, but in the destruction of the buildings, of which we now see only the ruins.

The first of these opinions, started by Mr Williams, was supported by Dr Anderson; and if we consider barely the possibility of forming walls which shall be cemented by the fusion of a part of the materials, there appears no reason whatever to doubt it.

But it is not whether a wall can or cannot be constructed of fusible materials, which is the question; but whether the appearances which now present themselves justify the assumption that they had such an origin. We have already shewn that the people, who had seen the possibility of heat being applied successfully to cement a wall on the hill of Dun Creich, had not availed themselves of what must have been long apparent to them. No wall, or part of a wall, of a uniform thickness or height, has ever been seen vitrified on both sides, or throughout, so as to indicate a regular mode of procedure in its formation. We find, indeed, a general regularity in the form and manner in which the ramparts are laid down, and which has been guided by the shape of the hills: but nothing else than irregularity in the mass of which they are formed. We speak of all those we have seen, and of a variety of descriptions which we have read. We often find masses of melted matter of a breadth far exceeding what can be imagined the limits of a wall; and we find them, too, as on Craig Phadrick, on the brink of inaccessible precipices, where no wall was necessary. When a breadth of vitrified stones extending 40 feet is mentioned, it instantly occurs as being very unlikely that the labour of constructing such a wall was thrown away, since one half the thickness is far beyond the strength necessary for a rampart. There is little difficulty in conceiving how signal fires, kindled sometimes in one place, sometimes in another, and varying in magnitude as occasion required, might spread over a surface of forty feet. The shifting of the wind, and the violence with which it blows on the tops of such hills, was sufficient to put those who had the charge of making signals, on some contrivance to prevent the wood from being dispersed, and themselves from being annoyed; and thus the ramparts of loose stones which they had raised to defend themselves from being surprised, may have become stronger without their having had any intention of making them so. It is nevertheless by no means unlikely, that in some cases, the fusible nature of the stones might have been taken advantage of; but there is nothing which we have been able to discover, to justify the idea that a regular method for raising walls and cementing them by fire, was ever in use. On the hill of Dun Jardil, Mr Tytler could discover no marks of vitrification; yet such marks were discovered by Mr Nimmo, on the only part of the hill where signals could be made, so as to connect the great chain of posts extending from coast to coast; and along this chain it has been found necessary to make use of hills on both sides of the valley, in order to complete the communication. Here, then, is another instance in which the fusibility of the stones has not suggested the idea of strengthening walls by means of fire. But we have said enough on this part of our subject.

Mr Tytler has accounted for the present irregular distribution of the vitrified matter, in a more simple and in a more ingenious manner than Mr Williams and Dr Anderson. He supposes that the cause of the vitrification is to be found, not in the mode of constructing, but in the means employed to demolish the ramparts; which, according to his theory, were originally built with stones intermixed with wood, thus presenting to an enemy a defence easily destructible by the application of fire.

It is difficult to find any reason why such structures should be made, at a time when the effects of fire upon wood must have been as well known as at present. At a period when it was the only fuel made use of or known, little ingenuity was necessary for discovering that any structure made wholly or partly of wood, could easily be destroyed by fire; and the people must have been very silly indeed, who were incapable of foreseeing that the ingenuity of their enemies might enable them to find out so simple, and, to such fortifications as Mr Tytler has constructed for them, so formidable a weapon. It was necessary that such a structure should be only once destroyed by fire, to prove to the inhabitants the frail nature of their defence. And if their enemies were expelled, it is natural to suppose that they would have renewed their forts, and constructed them in a different manner, so as to resist the attacks of fire. But nothing has been found indicating any renewal of the fortifications. That a rampart may be constructed of stones and wood, which shall not be liable to destruction by fire, and that such ramparts have been formed, there is no reason to doubt. But, in the case before us, it is necessary that the quantity of wood should have been so great, as to admit of fire being set to it easily. If Mr Tytler's conjecture be right, we ought to find the melted matter pervading indiscriminately every part of the rubbish. But the vitrification is only superficial, extending but a very little way among the stones.

These few considerations, together with what we have already stated in favour of another, has induced us to reject Mr Tytler's hypothesis. On the whole, we are of opinion, that the antiquity of these structures is by no means so great as that which has been attributed to them, and that they have served as beacons to castles in their vicinity, the remains of which are, in almost every instance, to be found.

We allow that, while these hills were chosen for signal stations, they were also used as places of defence. And, indeed, it would have been strange if posts of so much importance had been left without the means of resistance. All have agreed that they were places of more or less strength, though perhaps such lofty and exposed situations were not well chosen for protracted warfare. Had they been merely places of retreat, an invading enemy would certainly overlook them, as he could overrun and pillage the country without the possibility of his being annoyed from them; or if there was any risk of his progress being interrupted, the situation of the hills would render it easy for a small party to coop up the garrison. But as an enemy would always endeavour to approach unseen, and to prevent the country from being alarmed, these stations would undoubtedly be objects of attack; and hence we should be warranted in supposing that they were, to a certain extent, fortified, even were the appearance of ramparts less unequivocal.

Nor are we disposed to deny, that, in some instances, the fusibility of the stones may have been made use of to assist in strengthening the ramparts; though nothing has yet occurred to our observation, or in the course of our reading, which we consider as carrying with it any thing like demonstration, or even the suggestion of any such method of constructing them.

Our object, in this article, being chiefly to excite curiosity, and to induce such of our readers as may have an opportunity of visiting these curious remains, to apply, on the spot, the different hypotheses which have been stated, and to favour the public, through some channel or other, with the result of their observations, we shall now proceed to point out the situations of some of the most remarkable vitrified forts in various parts of Scotland, besides those already mentioned.

In Kirkcudbrightshire, about half a mile S. E. from the church of Anwoth, is a steep rocky hill about 300 feet high, which has been fortified on the most accessible places by a double fosse. On the summit, the following appearances present themselves, as described by the Rev. Hugh Gordon. "The top, which forms a level area, 30 paces long and 20 broad, is nearly surrounded with an irregular ridge of loose stones, intermixed with vast quantities of vitrified matter. The stones, consisting of the common blue schistus of the country, have been softened, twisted, and partly fused by the fire. These heaps of loose stones and vitrified matter are scattered irregularly over the top of the fort, and exhibit no appearance of having ever formed a continued wall. The vitrification is only partial and superficial, and seems to have been the accidental effect of large fires kindled on these high rocks, either for some domestic purpose, or for signals to alarm the country on the approach of an enemy. It was formerly believed that these vitrified forts were peculiar to that part of the island which is north of the Forth. But besides the one described above, there are two others in the country, and they all command a very extensive prospect of the sea."

In the island of Bute, in the parish of Kingarth, there is a vitrified fort; and in Cantire, at the entrance of the bay of Carradale, on a small island, vitrified masses enclose about a rood of ground. We believe that some others have been observed in Argyllshire, particularly one on the hill of Dunskeig, which commands the entrance of Loch Tarbert. On the same hill, ramparts are seen constructed with dry stones, without any vitrification.

In Perthshire, the hill called Barryhill, in the parish of Meigle, seems to have been fortified with particular care. Dr Playfair thus describes it: "Its summit was levelled into an area 180 feet long, and 72 broad. Around the area, a mound of earth was raised from 6 to 8 feet high, and 10 to 12 broad at top. On this mound a wall of freestone was built, without any cement whatever. The foundation of the wall was composed of rough granite, and still remains. It is of the same breadth with the summit of the mound; but the height of the wall cannot be known. Gordon's estimate of it is very erroneous. Among the ruins there are several pieces of vitrified stone; but these vitrifications must have been accidental, as they are few and inconsiderable. Along the west and north borders of the area, are barracks or huts of dry stone, and sufficiently sheltered by the mound and wall; but no structures of this sort can be traced in the south part of the area. As the north and west sides of the hill are steep, and of difficult access, there was no need of an outer ditch in these quarters; but towards the south and east, where the hill gently slopes, there is a ditch 10 feet broad, and 12 to 16 feet below the foundation of the wall. At the S. E. extremity of the fort, a narrow bridge was raised over the ditch, 18 feet long, and 2 broad, except towards each end, where the breadth was increased. It was composed of stones, laid together without much art, and vitrified above, below, and on both sides, so that the whole mass was firmly cemented. That an opening was left below, after the process was finished, is doubtful. On the upper part of the bridge, a stratum of gravel was laid, to render the passage smooth and easy. This is the sole part of the fort intentionally vitrified. A few yards distant from the ditch, there is an outer wall, the foundation of which is about eight feet lower than the summit of the mound. The approach to the fort is from the north-east, along the verge of a precipice; and the entrance was secured by a bulwark of stone, the ruins of which are extant. There is no vestige of a well within the fort; but, westward, between the basis of the mound and the precipice, there was a deep pond or lake, recently filled up by the tenants in that neighbourhood. About a quarter of a mile eastward, on the declivity of the hill, there are some remains of another oval fort, of less extent than the preceding, consisting of a strong wall and ditch. Tradition says that there was a subterraneous communication between these forts, which is not improbable." We could have wished that more particular attention had been given to what is denominated a bridge in the foregoing description. From the circumstance of this vitrified mass crossing the ditch, Dr Playfair is satisfied that it must have been used as a bridge; but he afterwards decidedly says that the approach to the fort was on the north-east side, while this bridge is at the south-east extremity. We are inclined to think, that, at this side, the south-east, was found the most convenient spot for making signals, and that the vitrified mass was raised, in order to allow of a fire being kindled on either side, according to the direction of the wind. The plausibility of this conjecture, we must leave to the decision of future observers.

From a hill called Laws, near the village of Drumsturdymuir, about five miles north-east from Dundee, there is an extensive view of the sea and adjacent country. The area on the summit is 133 yards in length, and 66 in breadth; and all round it are to be seen the vestiges of a broad rampart. On the east end, from which the most extensive view is seen, are large masses of vitrified stones. The Rev. Mr Roger, who gives a short description of this fort in the Statistical Account of Scotland, states his opinion that these vitrifications have been produced by the frequent lighting of signal fires.

The vitrifications on the hill called Top of Noth, have already been noticed, on account of their being found only on the inside of the ramparts, a fact confirmed by several authorities. The following description we met with accidentally in a MS. the writer of which appears to have been Mr Leith of Whitehaugh. "The summit, on all sides, presents to a person who approaches it, a sloping mound, or pile of loose stones, of different sizes and shapes, few of them larger than a man may lift with both hands, though some few are ten times that bulk. When you get on the top of this mound, or enter by an opening in the east end of it, you discover that it does not consist of a heap of such stones so as to make a large cairn, but that there is an open area of grass ground in the middle, which may be about 60 yards long, by 25 wide. The mound of stones which surrounds this space has, on the inside, the appearance of a thick strong wall that had for a long time been in ruins. The height of these ruins above the inner area is pretty uniform, and may be from 9 to 12 feet. A slight inspection discovers, that what has the appearance of a ruinous wall, has never been connected together by any cement, as nothing of that sort can be discovered where it might most probably be found. But, at the same time, you perceive that very large masses have been formed by the union of smaller stones fused by the force of fire in various degrees."

In the same county is the hill of Dun o' Deer, in the vale of Garioch, on which there are also vitrifications; and, as on Dun Creich, the remains of a building constructed with lime mortar. This tower is of larger dimensions, and of greater strength, than that on Dun Creich, being 60 feet square, and the walls about 12 feet in thickness. Hence it appears to have served the double purpose of a watch-tower and a stronghold. This tower is evidently of more modern date than the vitrifications, part of which have been used in its construction. This circumstance, however, does not militate against the supposition, that the hill was used as a signal-station after the tower was built.

About four miles east from Forfar, is the castle-hill of Finhaven, the vitrifications on which have led Dr Anderson to compare them to the effects of the fire in a limekiln; and he represents them as having been produced by the irregularity of the weather, the wind blowing sometimes hard, sometimes gently. This is exactly what we suppose to have been the cause of the vitrifications, while we ascribe a particular purpose to the fire.

The walls in some parts of this fort have been laid bare, so as to appear at least ten feet high. We have no perfect description of the vitrification. Dr Anderson describes it as appearing here and there in horizontal, or nearly horizontal streaks; but it is evident, that the wall had been built previously to the application of fire, in whatever way that may have been made. The stones are in courses, and banded, as we have been informed by the Rev. Dr Jamieson, (to whom we are chiefly indebted for what we state respecting this fort), and the stones have been very unequally and irregularly affected by the fire, and many of them not at all. Seven or eight varieties of stone appear to have been made use of. Had there been an intention to vitrify this wall, the most fusible stones would appear to have been selected; but instead of this, they have been placed in the wall indiscriminately with others. We have already remarked, that much pains seem, in some instances, to have been taken to fill up irregularities in the ground, so as to form a level area on the summit. Our information respecting this fort is not so clear as to enable us to determine whether the unusual height of the wall can be accounted for in this way. For defending a fort from within, a rampart of less height would have been sufficient. There are several cross walls on this hill, and the vestiges of outworks; and altogether it seems to offer much satisfaction on a careful examination. We regret, that our information, in regard to some of its peculiarities, came too late to enable us to visit the castle-hill of Finhaven, before it was necessary to send this article to the press. It is said, that between this hill and that of Laws, already noticed, there is another fort, which completes the communication over a very wide extent of country. By keeping in view the idea, that signals by fire have been in use at the period when these fortifications were constructed; and looking around from the summit of the hills on which they have been placed, for hills similar in situation and shape, particularly at the entrances of vallies, or on ridges which interrupt the view; many vitrified forts will, we confidently expect, be discovered, and communications far more extensive than any hitherto observed may be traced. As the repulsion of foreign invasion was an object of interest to the country at large, hostile tribes and clans would naturally unite for the common defence; and, as their Scandinavian neighbours were in the habit of frequently molesting them, no plan for alarming the country with the utmost celerity appears so natural, or so effectual, as the lighting of fires.

A few miles from Fort-William, in the parish of Kilmalie, is the hill of *Dundhairdghall*, the summit of which is surrounded by a vitrified mass of stones. This hill commands a view of a great part of Mamore, and the whole of Glen Nevis. It is extremely probable, that this was the signal station of the ancient castle of Inverlochy. In this opinion the writer of this article was confirmed by Dr M'Knight, who visited this hill, and who has mentioned his being struck with the probability of the conjecture, in the account he has given of Ben Nevis in the Memoirs of the Wernerian Natural History Society.

In the valley of the Beauly river, in Inverness-shire, about two miles north-west of the church of Kiltarlity, is a vitrified fort, called Dun Thioan. It is circular, and about thirty yards in diameter.

The latest writer on the subject of our article is Dr M'Culloch, who states his opinion in a memoir, published in the Transactions of the London Geological Society. He adopts the opinion of vitrified forts having been constructed as places of defence, by cementing the walls by means of fire; and rejects, in a peremptory manner, the opinion which we have attempted to defend, viz. that the origin of the vitrifications is to be found in the practice, universally employed by our ancestors, of alarming the country, when threatened by invasion, by fires lighted on conspicuous situations.

Dr M'Culloch has guessed, by pacing, the dimensions of the ground plan of the vitrifications on the hill of Dun Mac Sniochain, supposed to have been part of the ruins of Beregonium. He acknowledges, that a great part was concealed by being covered with sod, which he had no means of removing; yet he has given a plan of an extensive and regular set of inclosures. He has not favoured us with the shape of the summit, on which the position of the vitrified masses observed elsewhere always depends; but, from the shading of his plan, we may presume, that the inclosures stand on different elevations, and that those elevations command a view of different portions of country. It is stated, that the portion of ground inclosed is in length about 200 yards; whereas on the plan two separate inclosures are marked, one 56 paces long, and the other 37. One side of the latter appears to be prolonged, so as to reach the edge of the hill at both sides. There is a third inclosure, 30 paces long. The want of a vertical section, or a drawing of the hill, prevents us from judging of the extent of Dr M'Culloch's title to set aside the idea of signal fires having been the cause of the vitrifications. The facility with which our author makes room for his own opinions, may be seen in the following sentence: "The supporters of this opinion have asserted, that they (the forts) always occupy the highest elevation; and that many of them are so placed as to be visible from each other. This is not true." The vitrified forts have never been asserted to occupy the *highest elevation*, and we cannot discover where Dr M'Culloch could find such an assertion to have been made. We do not remember an instance, in which there is not much higher ground immediately contiguous to the hills on which the vitrifications are found. It has been asserted by others, as well as by ourselves, that they are placed in commanding situations, from which an extensive view of the sea, or inland districts, can be seen. But this is very different from the highest elevation. That many of them are so placed as to be visible from each other, is known from the testimony of several writers, and is consistent with our own observation.

The rock of which the hill in question is formed is limestone; and Dr M'Culloch very properly infers, that the stone of the hill was rejected, on account of the effects of fire upon it, and that other stones were, therefore, collected in the vicinity. He supposes, that a trap breccia, found *in situ* about half a mile from the hill, was chiefly made use of, on account of its being fusible. Yet he states, that only the foundation of the wall is cemented together by melted matter. The masses of this rock are said to be rare on the plain near the hill; but it cannot be inferred from this, that they were not found in sufficient plenty at the time the rampart was constructed. The building of the rampart most probably occasioned the present scarcity of stones of this kind on the plain. But this is comparatively unimportant, since we have vestiges, in various places, which demonstrate the great labour which the ancient inhabitants of the country bestowed in collecting stones of particular sizes and shapes to suit their purposes. The vitrification extending, according to Dr M'Culloch, "in no case more than a foot or two from the foundation," does not, in our opinion, exhibit any sign of intention to construct a vitrified wall; and the effects of the fire appearing, in this instance, to diminish upwards, is precisely what we should expect to be the consequence of lighting signal fires against the rampart in the manner we have supposed. The reason why the pudding-stone is the prevailing material, appears in its being more easily broken into pieces of a convenient size than any other stone, and more easily quarried (if quarrying was necessary) than the hard primitive rocks.

From what we can collect out of this description, we are inclined to think it possible that a rampart of loose stones has been constructed on the vitrified mass, which is described as the foundation. Should this conjecture prove correct, it will be an additional proof that the fusibility of the materials has not always been made use of for the purpose of cementing them. Indeed Dr M'Culloch comes nearly to the same conclusion, as he has found it necessary to state the following hypothesis, which appears to us a very lame apology for builders neglecting their work; at all events, Dr M'Culloch has satisfied us, that the art of building walls, by means of fire, was not, in the present case, sufficiently perfect to raise a structure higher than a foot or two. "The imperfect ustion of the upper parts, may be easily conceived to have arisen from a partial neglect of the fire after the wall had nearly attained its requisite height; nor is there any reason why it should not have been increased in height, by the addition of cold stones, after a firm foundation had been obtained." We do not see why a foundation of vitrified stones should be firmer than the solid limestone rock, on which they are placed. Dr M'Culloch observes, that the effects on the stones appear to have been produced by repeated applications of fire; an observation which accords exactly with the supposition of signal fires. We cannot discover, along with our author, any analogy between the appearances we have been considering, and the method employed to bake mud walls employed in Hindustan. Melting and baking we consider as very different things. In regard to the plan which has been supposed to have been followed in constructing vitrified walls, and which is approved by our author, we have only to observe, that the great heat necessary to fuse the stones, could not possibly be produced between two walls built of sods, or any thing else, which would prevent a proper current of air from passing through the fuel. To us the analogy to the glazed wall of Gatacre House in Shropshire, appears equally remote.

We hope, by the time we come to the article VITRIFIED *Forts*, that we shall have it in our power to throw some additional light on this obscure subject. Our remarks in this article, particularly those on Dr M'Culloch's memoir, shew how difficult it is to arrive at any settled opinion at present; though to us it appears evident that, to whatever use the fusibility of some stones may have been afterwards applied, the lighting of signal fires has caused the vitrifications at least in some instances; and, if not in all, that it has afforded the hint from which the idea of cementing stones by means of their fusibility has been derived. If it be really the fact, that walls were built in this manner, it is remarkable that no trace is left by which we can determine the method which was followed in their construction. The only data we possess on which our arguments in favour of this mode of building can be founded, are, the presence of great varieties of stones, a few of which are fusible at a high temperature, and of charcoal, which indicates the nature of the combustible materials. It is evident that the hills on which these remains have been discovered have been fortified with more or less care, and to a greater or less extent; and the question that remains is simply, What has been the purpose to which the fire, which fused the stones, was applied?—Was it applied to strengthen the walls by the builders; to destroy them by an enemy; or, have the vitrifications been the accidental effects of signal fires; or can we trace their origin to all of these?

See Williams's *Letters from the Highlands*. *Archæologia*, vol. vi. *Bee*, vol. x. *Transactions of the Royal Society of Edinburgh*, vol. ii. *Statistical Account of Scotland*, passim. *Memoirs of the Wernerian Nat. His. Society*, vol. i. *Transactions of the Geological Society of London*, vol. ii.

FORTUNATE ISLANDS. See CANARY ISLES.

FOSSILS. See MINERALOGY and PETRIFACTION.

FOSTAT. See CAIRO, p. 214.

FORTROSE. See Ross-shire.

FOULAH, an island in the Atlantic Ocean, connected with Zetland, from which it is distant about 20 miles west. It is situated in North Latitude 60° 4′, and West Longitude 1° 45′. It is about three miles long, and one mile broad, chiefly formed of very high ground, and presenting to the ocean several precipices from 800 to 900 feet in height. There is one landing-place, which can be taken in calm weather only. During a storm, all is foam and spray, and the island is then inaccessible. The rocks are gneiss and mica slate, supporting horizontal beds of sandstone, slate, clay, and clay-ironstone. In the cliffs of sandstone, innumerable multitudes of sea-fowl hatch their young. When approached in a boat, in the breeding season, if any noise is made, the old birds leave their nests in such numbers as to darken the air. Here the different kinds of gulls resort, and here also the stormfinch (*Procellaria pelagica*) breeds. On the hills, the Skua gull may be found; and in the corn-fields of this remote island, the voice of the land-rail proclaims summer.

The inhabitants, which do not amount to 200 souls, chiefly support themselves by fishing. They occupy about 60 marks of land, which they cultivate with the spade, and rear a few horses, sheep, hogs, and poultry. The rocks, in summer, yield the natives a rich supply of eggs and feathers. In order to procure these, they run the greatest risks among the rocks, climbing by the assistance of a rope among the most frightful precipices. As may be expected, many of these adventurous natives meet with an untimely death. This, to the relatives, while a subject of grief, is likewise matter of exultation, as the children will often be heard to boast that they are the descendants of those who have *gaen afore*, or of those who have perished among the rocks.

Several places along the shore were pointed out to the writer of this article, where these melancholy events had taken place.

This island is seen in clear weather from the Orkneys, and hence is supposed, with great probability, to have been the *Ultima Thule* of Tacitus.

FOULNESS. See Essex.

FOUNDATION Octave, in Music, or "the Foundation," in the language of practical *tuners* of organs and piano-fortes, implies, that series of 12 notes which are first adjusted, by their tuning process, and from whence all the others above and below them are tuned by means of octaves: many tuners are in the habit of laying their foundation, as they call it, between the G that is below, and that which is above the Tenor-cliff C; but we prefer the octave above the latter note, and to this octave C c, are the tables of beats for different systems calculated, that are given in our work; the lower note making 240, and the upper one 480 complete vibrations per second. (ϱ)

FOUNDERING. See Veterinary Medicine.

FOUNDERY. See Iron and Gunnery.

FOUNTAINS. See Hydrodynamics.

FOURTEENTH, *Comma-redundant Minor* (14′), in Music, is an interval, whose ratio is $\frac{5}{18}$, = 1131 Σ + 22 f + 98 m, and its log. = .4486974,9024. It is equal 2 V + 6, by which it may be correctly tuned.

Fourteenth *Major* (XIV), or *Quatorzieme*; the octave or replicate of the major seventh, has the ratio $\frac{4}{15}$, = 1167 Σ + 23 f + 101 m, and its log. = .4259687,3227. It is equal 2 V + VI, by which it may be tuned.

Fourteenth *Minor* (14), the octave or replicate of the minor seventh: its ratio is $\frac{9}{32}$, = 1120 Σ + 22 f + 97 m, and its log. = .4490925,3112. It is = V + 3 4ths, whence it may be tuned. (ϱ)

FOURTH, in Music, is the *numeral* designation of an interval of four diatonic degrees, or literal gradations. Of these fourths, the different writers on music have mentioned a considerable variety, and by a still greater number of names, as follows; (see Plate XXX. Vol. II.), viz.

Bearing Fourth of Holden: its ratio is $\frac{16}{21}$, = 240.060766 Σ + 5 f + 20 m. See *Lesser False Trumpet* Fourth.

Comma-deficient Major Fourth (IV‵), has the ratio $\frac{18}{25} = \frac{2.3^2}{5^2}$, = 290 Σ + 6 f + 25 m; its common log. is = .8573324,9643, = .478982 × VIII, = 26.44423 × c; = IV − C, = 4 + 𝒮, = T + 2 t, 3 T − 2 c, = V − S − c, = 25 c + 15 Σ + 6 f, = 6 ƒ + 13 € + 10 Σ: it is also = VI − 3, by which means it may be accurately tuned. It is the grave major fourth of Maxwell and Liston; the sharp fourth, or the greater fourth of some writers; the superfluous fourth of Chambers and Marsh; the double-deficient tritone, and the tritonus of Euler.

Comma-deficient Minor Fourth (4‵), has the ratio $\frac{243}{320}, = \frac{3^5}{2^6.5}$, = 243 Σ + 5 f + 21 m; its log. = .8804562,9528, = .397117 × VIII, = 22.15811 × c; = 4 − c, = IV − P, = III + L, = 2 t + S, = 21 c + 12 Σ + 5 f, = 5 ƒ + 11 € + 8 Σ; it is also = 3 4ths − V − 3, by which it may be tuned. It is the deficient fourth of Holden, the lesser fourth of Holden, the grave minor fourth of Liston, and the superfluous third of Good.

Comma-redundant Major Fourth (IV′), has the ratio $\frac{512}{729}, = \frac{2^9}{3^6}$, = 312 Σ + 6 f + 27 m; its log. = .8465424,3266, = .509772 × VIII, = 28.44423 × c; = IV + c, = 4 + P, = V − L, = 3 T, = 3 P + 3 L, = 4 + 𝒮 + 2 c, = 27 c + 15 Σ + 6 f, = 6 ƒ + 15 € + 12 ƒ; it is also = 3 V − 3 4ths, and may be so tuned. It is likewise the acute major fourth of Liston, &c.; the greatest sharp fourth, the sharp, and the superfluous fourth of Bemetzrieder; the treble major tone, the great tritonus, the ancient superfluous or redundant tritone, &c.

Comma-redundant Minor Fourth (4′); its ratio is $\frac{20}{27}, = \frac{2^2.5}{3^3}$, = 265 Σ + 5 f + 23 m; its log. = .8696662,3150, = .432958 × VIII, = 24.15811 × C; 4 + C. = IV − 𝒮, = II + 3, = IX − VI, = 10 − 7, = 3 + T, = 2 T + S, = T + t + S, = T + t + L + 2 c, = 23 c + 12 Σ + 5 f, = 5 ƒ + 13 € + 10 Σ: it is also = 2 V − VI, by which it may be tuned. This is also the acute minor fourth of Liston, and his diminished (major) fourth, the redundant fourth of Chambers, the superfluous fourth of Galileo, and the greater fourth of Holden.

Deficient Fourth of Holden, has the ratio $\frac{243}{320}$, = 243 Σ + 5 f + 21 m. See *Comma-deficient Minor* Fourth.

Diaschisma-excessive Minor Fourth (4ᵈ'); has the ratio $\frac{131072}{177147} = \frac{2^{17}}{3^{11}}$, = 266 Σ + 5 f + 23 m; its log. = .8691761,2437, = .434583 × VIII, = 24.24895 × C; = 4 + đ, = IV + Σ — ℑ, = IV + C — L, = V — 2 L, = 2 P + T, = 3 P + 2 L, = 23 c + 13 Σ + 5 f, = 5 Σ + 13 € + 11 Σ; it is also = 5 V — 6 4ths, by which it may be tuned. This is the resulting or wolf fourth, when 11 perfect fourths are tuned in 5 octaves, or it is = 5 VIII — 11 4ths.

Diminished Fourth of Bemetzrieder; its ratio is $\frac{6561}{8192}$, = 196 Σ + 4 f + 17 m. See *Least flat* Fourth.

Diminished Fourth of some writers, has the ratio $\frac{405}{512}$, = 207 Σ + 4 f + 18 m. See *Lesser flat* Fourth.

Diminished (*major*) Fourth; its ratio is $\frac{20}{27}$, = 265 Σ + 5 f + 23 m. See *Comma-redundant minor* Fourth.

Diminished (*minor*) Fourth of Tartini, Chladni, Marsh, Liston, &c.; has the ratio $\frac{25}{32}$, = 218 Σ + 4 f + 19 m. See *Extreme flat minor* Fourth.

Double deficient flat Fourth, has the ratio $\frac{6561}{8192}$, = 196 Σ + 4 f + 17 m. See *Least flat* Fourth.

Double diminished minor Fourth; its ratio is $\frac{625}{768}$, = $\frac{5^4}{2^8.3}$, = 182 Σ + 3 f + 16 m, or as a regular interval = 181.858201 Σ + 4 f + 15 m; its log. = .9105187,9731, = .297249 × VIII, = 16.58587 × c: = 4 — 2 ℑ, = IV — 𝔖 — 2 ℑ, = 3 + ℰ, = 3 5 + c, = V + ℰ — III, = T + t + ℰ, = T + 3 S — t, = 16 c + 6 Σ + 3 f, = 3 ƒ + 10 € + 7 Σ: it is also = 6 + 3 — 2 III, = XIII — 4 III, by either of which it may be tuned. This interval has also been called the extreme diminished fourth by Chambers, and it is the enharmonic-excessive minor third.

Double minor Fourth (2 4th); its ratio is $\frac{9}{16}$, = 508 Σ + 10 f + 44 m. See *Minor* Seventh.

Extreme diminished Fourth of Chambers: has the ratio $\frac{625}{768}$, = 182 Σ + 3 f + 16 m. See *Double diminished minor* Fourth.

Extreme double sharp minor Fourth (✱✱4); its ratio is $\frac{256}{375}$, = 337 Σ + 7 f + 29 m. See *Extreme sharp major* Fourth.

Extreme flat major Fourth (♭IV); has the ratio $\frac{3}{4}$, = 254 Σ + 5 f + 22 m. See *Minor* Fourth.

Extreme flat (*minor*) Fourth (♭4) of Liston, &c.: its ratio is $\frac{25}{32}$, = $\frac{5^2}{2^5}$, = 218 Σ + 4 f + 19 m; its log. = .8927900,3035, = .3561435 × VIII, = 19.87198 × c; = 4 — ℑ, = IV — 𝔖 — ℑ, = 2 + 3, = 9 — VI, = 10 — VII, = 3 + S, = T + 2 S, = 3 + ℰ + ℑ, = 19 c + 9 Σ + 4 f, = 4 ƒ + 11 € + 8 Σ; it is also = VIII — 2 III, = 6 — III, by either of which it may be tuned. It is the diminished fourth of Tartini, &c. the flat (minor) fourth of some writers; also the diesis-excessive major third, III + ℰ, and the bearing third, or tierce wolf, of the mean-tone system.

Extreme sharp (*major*) Fourth (✱IV) of Liston; has the ratio $\frac{256}{375}$, = $\frac{2^8}{3.5^3}$ = 337 Σ + 7 f + 29 m; its log. = .8342086,9759, = .5507472 × VIII, = 30.641154 × c; = IV + ƒ, = 4 + 𝔖 + ƒ, = V — E, = 2 III — S, = III + 2 𝔖 + ƒ + €, = 29 c + 18 Σ + 7 f, = 7 ƒ + 15 € + 12 Σ; it is also = 3 III — 4, by which it may be tuned. It is likewise the redundant (major) fourth of Liston, and his extreme double sharp minor fourth.

Extreme sharp minor Fourth (✱4): its ratio is $\frac{32}{45}$, = 301 Σ + 6 f + 26 m. See *Major* Fourth.

False Fourth of Chambers; has the ratio $\frac{32}{45}$, = 301 Σ 6 f + 26 m. See *Major* Fourth.

Flat deficient minor Fourth; its ratio is $\frac{405}{512}$ = 207 Σ + 4 f + 18 m. See *Lesser Flat* Fourth.

Flat Fourth of Holden; has the ratio $\frac{7}{9}$ = 221.947209 Σ + 4 f + 19 m, and its log. = .8908555,3085. In the incongruous system of this writer, it is also his redundant great third.

Flat (*minor*) Fourth (♭4), of some writers; has the ratio $\frac{25}{32}$ = 218 Σ + 4 f + 19 m. See *Extreme flat minor* Fourth.

Grave Fourth, of Holden; has the ratio $\frac{16}{21}$, = 240.060766 Σ + 5 f + 20 m. See *Lesser false* Fourth.

Greater Fourth, or sharp fourth, has the ratio $\frac{32}{45}$, = 301 Σ + 6 f + 26 m. See *Major* Fourth.

Greater Fourth, of Holden; has the ratio $\frac{20}{27}$, = 265 Σ + 5 f + 23 m. See *Comma-redundant minor* Fourth.

Greater Fourth, of some writers; its ratio is $\frac{18}{25}$, = 290 Σ + 6 f + 25 m. See *Comma-deficient major* Fourth.

Greater false Fourth, of the trumpet ($\frac{1}{21}$); has the ratio $\frac{32}{43}$, = 260.89592 Σ + 5 f + 22 m, and its log. = .8716815,2274.

Greater false Fourth, of the trumpet ($\frac{8}{11}$ $\frac{1}{22}$ $\frac{1}{44}$); has the ratio $\frac{8}{11}$, = 281.102040 Σ + 6 f + 24 m, and its log. is .8616973,0183.

Greatest sharp Fourth: has the ratio $\frac{512}{729}$, = 312 Σ + 6 f + 27 m. See *Comma-redundant major* Fourth.

Imperfect Fourth, of Good and Gregory: has the ratio $\frac{50625}{65536}$, = $\frac{3^4.5^4}{2^{16}}$ = 228 Σ + 4 f + 20 m; its log. = .8878851,0560, = .3724368 × VIII, = 20.781136 × c: = 4 — ∂, = IV — 2 S — Σ, = 20 c + 8 Σ + 4 f, = 4 ƒ + 12 € + 8 Σ; it is also = 4 4ths — 4 III, by which it may be tuned. This is also the quadruple major semitone, = 4 S.

Least flat FOURTH, of some writers; has the ratio $\frac{6561}{8192}$, $=\frac{3^8}{2^{13}}$196 Σ+4 f+17 m; its log.=.9035800,9412, =.320303.×.VIII, = 17.87198 × c; = 4 — P, = IV — ℐ — P, = IV — Σ — T, = III — Σ, = 3 + ℐ — Σ, = T + 2 L, = P + 3 L, = 2 t + 2 S — T, = t + S + L, = 17 c + 9 Σ + 4 f, = 4 ƒ + 9 € + 6 Σ; it is also = 5 VIII — 8 V, = 5 4ths — 3 V, by which it may be tuned. It is the diminished fourth of Bemetzrieder, the double-deficient flat fourth; and the schisma-defective major third (III ,.)

Lesser False FOURTH of the trumpet $\left(\frac{1}{21}\ \frac{1}{42}, \text{\&c.}\right)$ has the ratio $\frac{16}{21}$, =240.060766 Σ +5f + 20m; its log. =.8819006,8792, =.3923175×VIII, =21.89089×c. It is also the bearing or grave fourth of Holden.

Lesser Flat FOURTH, of some authors; has the ratio $\frac{405}{512}$, $=\frac{3^4.5}{29}$, = 207 Σ + 4 f + 18 m. Its logarithm = .8981850,6224, = .338224×VIII, = 18.87198×c; =4—𝕊, =IV—2𝕊, =III+€, =3+L, =V+€—3; =4—I, =5—II, =7—IV, =8—V; =t+2S, =T+S+L, =IV—t—Σ, =18c+9Σ+4f, =4ƒ+10€ +7Σ. It is also =3 4ths—V—III, by which it may be tuned. It is the grave extreme flat (minor) fourth of Liston (♭4')3, the diminished fourth of some writers, and the flat deficient minor fourth.

Lesser FOURTH of Holden, has the ratio $\frac{243}{320}$, =243 Σ +5f+21m. See the *Comma-deficient Minor* FOURTH.

Major FOURTH (IV), or *Greater Fourth*, has the ratio $\frac{32}{45}$, $=\frac{2^5}{3^2.5}$, = 301Σ + 6 f + 26m; its logarithm =.8519374,6454, =.491853×VIII, = 27.44423×c; =4+𝕊, =III+T, =V—S, =5—€; I+4, =II+III, =V—2, =VII—4, =VIII—5, =IX—6, =X—7, =11—8; =3 T—c, =6—2S, =4+ℐ+c, =3S+2𝕊 +ℐ, =2 S+3 𝕊+ℐ+€; =26c+15Σ+6f, =6ƒ +14€+11Σ: it is equal V+III—4, by which means it may be correctly tuned. This interval is also the extreme sharp minor fourth, the sharp fourth, the redundant (minor) fourth, the false fourth of Euler, Chambers, &c. the superfluous fourth of Chladni, the tritone, (2T+t,) or tritonus. Mr F. Webb says, in his "Parharmonicon," that the ratio of this interval is nearly that of the side of a square to its diagonal; which correctly, is $1\div\sqrt{2}$, =306.0039312 Σ+6f+26m, the middle of the octave, or isotonic minor fourth, which is equally near to the 5th as to the IVth, the difference being ½€ in each case.

Major FOURTH of Hussey and Webb, has the ratio $\frac{5}{7}$, = 297.060766 Σ + 6 f + 25 m, and its logarithm = .8538719,6432; they also denominate it a sharp fourth.

Major FOURTH of Salmon, has the ratio $\frac{12}{17}$, = 307.53967 Σ+6 f+26 m, and its log. =.8487323,2467.

Minor FOURTH (4), *Fourth*, or *Perfect Fourth*, is a *concord*, having the ratio $\frac{3}{4}$, = 254Σ+5 f+ 22 m; its log. =.8750612,6339, =.4150374×VIII, =23.15811 ×c, =254.921293×Σ, =1.2892244×III, =1.5778829 ×3d; =IV—𝕊, =3+t, =III+S, =5—S, =V—T; =2+III, =IV—I, =5—2, =V—II, =7—4, VII—IV, =8—5, =9—6, =X—VII; =T+t+S, =2T+L, =T+t+L+c, =T+2L+P, =3S+𝕊+ℐ, =2½T—½đ, =22c+5r+2Σ, =22c+12Σ+5f, =5ƒ+12€+9Σ: it is also =6—3, =VI—III, =VIII—V, by either of which its tune may be examined and adjusted with the greatest exactness. This interval is the diminished (major) fourth of Liston, and his extreme flat major fourth (♭IV); the quatre of Euler; the diatessaron, or tetrachord, of the ancients; and the epitrites. It is the largest of the three CONCORDANT *Elements*, 3d, IIId, and 4th; see that article. It may be twelve times repeated, or tuned in succession, in five octaves, (11 4ths +4+đ=5 VIII), before falling again on the same note, or near to it, which is not the case with any other concord, except its complement the major fifth.

Minor-comma defective minor FOURTH (4*'); has the ratio $\frac{512}{675}$, $=\frac{2^3}{3^3.5^2}$ =244 Σ + 5 f + 21 m; its log. = .8799661,8814, =3.987441 × VIII, = 22.19905 × c: = 4 — €, =IV—S, =III+𝕊, = 3+ℐ+𝕊, =V— 2 S, = 5+Σ—S; =I+III, =IV—2, =VII—5, = X—8; = 2T+t—S, =2T+ℐ, = 21 c+13Σ+5f, = 5 ƒ + 11€+9Σ: it is also = V+2 III — 2 4ths, by which it may be tuned. It is the redundant (major) third of Liston, and his extreme sharp (major) third, ※III.

Redundant FOURTH of Chambers: has the ratio $\frac{20}{27}$, = 265 Σ + 5 f + 23 m; see *Comma-redundant minor* FOURTH.

Redundant (*major*) FOURTH of Liston, has the ratio $\frac{256}{375}$, =337 Σ + 7 f+29 m. See *Extreme sharp* (*major*) FOURTH.

Redundant (*minor*) FOURTH; it ratio is $\frac{32}{45}$, = 301 Σ + 6 f + 26 m. See *Major* FOURTH.

Schisma-excessive minor FOURTH (4*); has the ratio $\frac{8192}{10935}$, $=\frac{2^{13}}{3^7.5}$, = 255 Σ + 5 f + 22 m: its log. = .8745711,5626, = .416665 × VIII, = 23.24895 × c; =4+Σ, =IV—L, =V+Σ—T, =III+P, =3T—S, =22c+13Σ+5f, =5ƒ+12€+10Σ: it is also = 3V+III—4 4ths, by which it may be tuned; and if this be above tenor-cliff C (of 240 vib.) it will be found to *beat* sharp therewith 1.08387 per second: its length of string being .7491541. It is the minor fourth in FAREY'S *Equal Temperaments* (see that article), and is equal CE'※, and to fourteen other intervals on Mr Liston's EUHARMONIC *Organ*.

Sharp FOURTH, or *Greater Fourth*; its ratio is $\frac{32}{45}$= 301 Σ + 6f + 26 m. See *Major* FOURTH.

Sharp FOURTH, of Bemetzrieder; has the ratio $\frac{512}{729}$, = 312 Σ + 6 f + 27 m. See *Comma-redundant major* FOURTH.

Sharp FOURTH of Holden; has the ratio $\frac{7}{10}$, = 314.947096 Σ+6f+27 m, and its log. = .8450980,4001: it is also the flat fifth, and the lesser fifth of Hussey and Webb.

Sharp FOURTH of Hussey and Webb; has the ratio

$\frac{5}{7}$, $= 297.060766\,\Sigma + 6\,f + 25\,m$. See their *Major* FOURTH.

Sharp FOURTH of some writers; has the ratio $\frac{18}{25}$, $= 290\,\Sigma + 6\,f + 25\,m$. See *Comma-deficient Major* FOURTH.

Superfluous FOURTH of Bemetzrieder; its ratio is $\frac{152}{729}$, $= 312\,\Sigma + 6\,f + 27\,m$. See *Comma-redundant major* FOURTH.

Superfluous FOURTH of Chambers and Marsh; has the ratio $\frac{18}{25}$, $= 290\,\Sigma + 6\,f + 25\,m$. See *Comma-deficient major* FOURTH.

Superfluous FOURTH of Chladni; has the ratio $\frac{32}{45}$, $= 301\,\Sigma + 6\,f + 26\,m$. See *Major* FOURTH.

Superfluous FOURTH of Galileo; has the ratio $\frac{20}{27}$, $= 265\,\Sigma + 5\,f + 23\,m$. See *Comma-redundant minor* FOURTH.

Temperaments of the FOURTHS, in regularly tempered douzeaves: these are the same, but with contrary signs, as those of their complemental fifths, respectively, *i. e.* if the fifths have flat temperaments, the fourths will have sharp ones, and *vice versa*. Thus, if eleven of the fourths in an octave are alike tempered, the remaining one or wolf temperament will be = đ — the sum of these 11 fourth temperaments.

The eleven temperaments of the fourths, are each, $= \frac{1}{4}\,c - \frac{1}{4}$ temp. III; or $\frac{1}{3}\,c - \frac{1}{3}$ temp. VI; and the fourth wolf $= \frac{11}{4}$ temp. III $+ \frac{1}{4}\,c - E$; or $\frac{11}{3}$ temp. VI $+ \frac{1}{3}\,c - f$. (*e*)

FOWEY, or FAWEY, is a burgh and sea-port town of England, in the county of Cornwall. It is situated on the western bank of the river Fawy, which here swells itself into a spacious harbour. The town stretches for more than a mile along the banks of the river. The houses are principally built of stone, but the streets are so angular, and irregular, and narrow, that wheeled carriages cannot pass through any of them. The church is a large building, and seems to have been erected about the time of Edward IV. It has a large and two smaller aisles, and a handsome tower on the west. The market-house is large and spacious, and over it is a neat town hall, erected some time ago by Philip Rashleigh, Esq. and Lord Viscount Valletort, who then represented the burgh in parliament. The town also contains two good free schools, an alms-house for eight decayed widows, and a poor's-house. The ancient mansion, called the *Place*, or *Treffry-house*, is situated on an eminence on the north side of the church, and though now in a state of decay, has once been a handsome building.

The greater part of the inhabitants of Fowey are connected with the pilchard fishery. More than 28,000 hogsheads of fish are annually brought into this port. The harbour is now defended by two small batteries, and by St Catherine's fort, which stands on the summit of a magnificent pile of rocks, that bounds one of the creeks of the river. This fort was built by the townsmen, in the reign of Henry VIII. On both sides of the river Fawy, the scenery is extremely picturesque. The rocks are composed of a hard bluish slate, containing broad veins of jet quartz. The ruins of two square stone towers exist on the rocks on the opposite side of the harbour.

The following is the statistical abstract for 1811, including the town and parish:

Inhabited houses,	227
Families,	320
Ditto employed in agriculture,	50
Ditto employed in trade and manufactures,	75
Males,	554
Females,	765
Total population,	1319

West Long. 40° 37′ 31″, North Lat. of Fowey windmill, 50° 20′ 7″. See Polywhele's *History of Cornwall*; Maton's *Observations on the Western Counties*; and the *Beauties of England and Wales*, vol. ii. p. 410. (*w*)

FOWLING-PIECE. See GUN MANUFACTORY.

FOX, CHARLES JAMES, second son of Henry Fox, Lord Holland, and of Lady G. C. Lennox, was born on the 13th January O. S. 1748. He is said to have been extremely indulged in his childhood, and to have been gratified in all his humours, however whimsical or capricious. At an early age he was sent to Westminster school, and soon afterwards to Eton. There he was distinguished by his promising genius, his power in captivating the affections of his school-fellows, and the lead which he took in all their sports and frolics. From Eton he went to Oxford, where he was equally eminent for his literary attainments and his dissipated habits. At a very early period of life he made a short excursion to the Continent; and in 1768, before he was of age, he took his seat in the House of Commons as member for the borough of Midhurst. His first appearance was in opposition to the popular politics of the day; and he was one of those who resisted the return of Mr Wilkes for Middlesex. Under Lord North, he was first a Lord of the Admiralty, and afterwards of the Treasury; but differed from the Premier on some questions, particularly on that of the marriage act. After the death of his father Lord Holland, he was excluded from his seat at the Board of Treasury; and, his patrimony having been already consumed by unbounded extravagance, he became unhappily much addicted to the gaming table. In the debates on the differences with the colonies in America, he came forward as a powerful speaker in opposition to the ministry; at first appearing as only the pupil of Burke, but soon rising as the equal, and in many respects the superior, of that accomplished orator. The American war, though popular in its origin, recommending itself both to the pride and avarice of the nation, yet, by the repeated failures of our military operations, soon became odious to the people; and, by the exertions of Fox and his friends, was finally condemned in Parliament. Mr Fox then became Secretary of State under the new administration, of which the Marquis of Rockingham was the nominal head; and several acts were passed, which tended to reduce the influence of the crown, and to enforce a greater degree of public economy. But the hope of peace, which the nation had been encouraged to entertain, was not realized by the new ministry; and the death of the Marquis of Rockingham produced jealousies in the cabinet, which ended in Mr Fox's secession. The Earl of Shelburne was advanced to the situation of prime minister, and Mr Pitt, at the age of twenty-three, was made Chancellor of the Exchequer. A general peace was concluded; but Lord North and Mr Fox, who had hitherto appeared as the most determined enemies to each other, having united in a vote, declaring the terms of pacification inadequate, the treaty was condemned by Parliament, and the administration consequently resigned. A new cabinet was formed under the Duke of Portland, and Lord North and Mr Fox became joint Secretaries of State,—a coalition, which some have considered as fixing a stain on the political character of the latter; while others have marked it with high approbation, as a laudable suppression of party feuds for the good of the country. It was certainly, at the time, somewhat revolting to the moral feelings of the nation, and served to produce a deep impression of the insincerity of public men. The only transaction of importance, during this administration, was the India Bill of Mr Fox, which he introduced with great ability, and which passed the House of Commons by a strong majority. It was represented by its advocates as a wise and generous rescue of the natives of India from oppression; but was censured, on the other hand, as not merely an unwarrantable violation of the India Company's charter, but also as a measure full of danger to the constitution, inasmuch as, by lodging the whole patronage of India in a few persons, it produced a degree of political influence, which might be equally pernicious, whether it was added or opposed to that of the crown. Some suggestions of this nature, privately conveyed to the royal ear by a person out of administration, caused its failure in the House of Lords; and a new administration was formed under Mr Pitt, in the face of a majority of the House of Commons. In consequence of a dissolution of parliament, many of Mr Fox's friends lost their seats in the House; and his own re-election for Westminster was made the subject of a long and severe scrutiny, of which he loudly complained, as an unworthy persecution on the part of the court. Whatever were the views of Mr Pitt in the inquiry, whether to support the just rights of election, or to free himself from a political adversary, the House of Commons refused to concur in his wishes; and Mr Fox's return was sustained by a majority of nearly 40 votes.

For a long period, Mr Fox must be regarded, in his public life, as generally the opponent of Mr Pitt's measures; and, though his exertions, as his warmest admirers must allow, were sometimes calculated chiefly to harass the ministry, yet neither can it be denied, that, in many cases, they proved highly beneficial to the state. He vehemently opposed the commutation act, and the transfer of certain duties to the excise, a measure, of which the good effects are now generally admitted, and the commercial treaty with France in 1786, of which the principal fault certainly was, that it was too favourable to Great Britain to be long observed by the other country. He condemned also the propositions for assimilating the commercial regulations for England and Ireland, which nothing but the jealousy of political independence in the latter country could have enabled the opposition to set aside. He resisted especially the regency bill, during the king's illness in 1788; a question in which the two great political leaders of the country seem to have, in some degree, exchanged political principles. It was affirmed by Mr Fox, that the two Houses of Parliament had no other power than to declare the temporary vacancy of the throne, and that the Prince of Wales had then an unquestionable right, without any limitation in the prerogatives of royalty, to assume the vacant place. Mr Pitt protested against this doctrine, as little less than "treason against the constitution;" and maintained the right of Parliament both to appoint a regency, and to limit its powers, as circumstances might direct. He admitted, indeed, the expediency of nominating the Prince as regent, and of leaving him unfettered by any council; while Mr Fox also conceded the *adjudication* of the Prince's right to be the privilege of Parliament. It is scarcely possible to avoid the conclusion, that each party were in some measure, perhaps insensibly, swayed in their political views, by their own apprehensions and expectations. The bill was supported only by a small majority; but the king's recovery happily prevented all further discussion of its principle, which is perhaps one of the most delicate that can be publicly agitated.

Mr Fox displayed all the vigour of his talents in pushing the trial of Mr Hastings; and it is worthy of remark, that the second article of the charge, of which he was the mover, was admitted by Mr Pitt as containing matter of impeachment. He succeeded also in resisting the design of the premier to prevent, by an armed mediation, the occupation by Russia of the conquered territory between the Bog and the Dneister; and thus probably saved the country from being involved in an expensive and unwarrantable contest. In a few instances, these rival leaders are found to have concurred in supporting some of the most important measures of finance, and most essential principles of the constitution. Mr Fox supported Mr Pitt's motion for reforming parliament, by abolishing 36 rotten boroughs; and approved of the bill for establishing a sinking fund. On the other hand, he received the concurrence of the minister in his declaratory acts for asserting the right of juries to judge in cases of libel. But the most gratifying instance of their agreement appears in the measures which were proposed for the abolition of the slave trade; and, throughout the whole of this cause, so interesting to humanity, the character of Mr Fox is placed in the most favourable point of view. He entered, from the first, and with the greatest ardour, into the condemnation of that infamous traffic; and, without waiting for any enquiry into its accidental barbarities, or its general impolicy, wished, as every man of right feelings must have done, to denounce it at once, as, in every aspect, iniquitous and inhuman. He was one of the many excellent and enlightened individuals in Great Britain, who hailed, with friendly feelings, the rising liberties of France in the commencement of the year 1789; but it has been considered as in some measure derogatory from his political sagacity, that he did not sooner detect, in the progress of that revolution, the principles of anarchy with which it was fraught. It was in the year 1790, in a debate on the army estimates, that the French revolution was first noticed in the British Parliament; and Mr Fox having expressed his approbation in general terms, Mr Burke took occasion to point out the dangers which it threatened to regular governments. This drew a reply from Mr Fox, guarding his commendations of the French patriots, yet differing from the doctrines of his friend; and, though both speeches were full of strongly complimentary expressions, a separation was unequivocally implied between these two eminent characters, who had so long pursued their political career as the most faithful associates. Even in a succeeding session of Parliament, after the King of France had remained another year as a prisoner in his capital, Mr Fox is understood to have characterised the revolution in that country as a stupendous and glorious edifice of liberty, erected on the foundation of human integrity; and though he subsequently qualified his expressions, by limiting his approbation to the destruction of the absolute monarchy, yet his language unfortunately conveyed to multitudes, who revered his authority, or who wished to avail themselves of his name, a general sanction of French principles. He was very far, however, from being a republican theorist; and his lingering partiality to the French revolution may be ascribed to his general love of political freedom, his naturally ardent feelings, and particularly to his extremely unsuspicious disposition, which may have led him to confide too much in the good intentions of the first revolutionists in France. When, in 1791, the French monarch was committed to custody, and preparing for trial, Mr Fox expressed in Parliament a wish to interpose in his behalf, by some declaration of the opinion of the House; but afterwards concurred with Mr Pitt in abstaining from all interference, lest it might serve only to exasperate the National Assembly. In 1792, when seditious societies in Great Britain were corresponding with the National Convention, and the Alien Bill was proposed, in order to provide against Jacobin emissaries from France, Mr Fox seemed to consider these precautionary measures as stronger than the apprehended dangers required; and, while he execrated the murder of Louis XVI. he resisted the preparations for joining in the war against France, chiefly upon the principle, that whatever might be alleged as the ground of hostilities, the true object was to interfere in the internal government of the country.*

When a message from his Majesty, on the 12th of February 1793, announced the important intelligence, that the French convention had declared war against Great Britain and the States of Holland, Mr Fox, while he still insisted that the conduct of the British government had not been sufficiently candid and conciliating, was willing that the address from the House to the Throne should convey a promise of support against every hostile attempt of France, and in such other exertions as might be necessary to procure such terms of pacification as might be consistent with the honour of his Majesty's crown, the interests of his people, and the security of his allies. There can now be little doubt, that it answered the purposes of the despotic rulers who successively directed the military energies of France, to involve the nation in war with foreign powers; and that their triumphant troops could scarcely be termed a nation of freemen resisting the invasion of tyrants; yet it must be allowed, that Mr Fox's predictions, of the failure of the coalition against them, approached very near to the actual result. His forebodings, however, of the ruin of the British constitution, in consequence of the suspension of the Habeas Corpus Act, and the treason and sedition bills, have happily failed of their fulfilment; and, though the two last measures were no doubt infringements upon the freedom of the subject, yet as mere temporary enactments, they may be considered as justified by the alarming aspect of the times, and as sufficiently conformable to the spirit of our constitution, which supposes parliament to provide, by temporary laws, against special dangers. Even Mr Fox's resistance to these bills evidently rested only upon his disbelief of those seditious designs against the government, which could alone have rendered them necessary; and, although future events, particularly the confessions of O'Connor, have proved the existence of such treasonable practices, where Mr Fox had no suspicion of their being entertained; the same discoveries have equally shewn, that he was most unjustly charged with participating in any revolutionary schemes. But so unfavourable was the impression made by his speeches in parliament in that period of public agitation, that in 1798, his name was erased by his Majesty from the list of privy councillors; and so decided, on the other hand, was his disapprobation of the conduct pursued by the ministry, that, contrary to the opinion of many of his political friends, he forbore his attendance in the House of Commons till his services might seem more likely to benefit his country. He appeared, however, in his place, in opposition to the triple assessment bill, the income and property tax, and particularly the Union with Ireland, which he condemned principally on the ground of its being effected by means of influence, and in defiance of the general wishes of the Irish people. He was occasionally drawn from his retirement by the state of continental affairs; and was ready to support every motion, which favoured the opening of negociations for peace. He exerted all his powers especially in recommending a conciliating reply to the letter, which, in 1799, Bonaparte, as Grand Consul, addressed to the King of England, inviting negociation; and, though it has since been admitted by those who concur in Mr Fox's political views, that the able delineation given by Mr Pitt of the principles and aims of the French Chief, was extremely correct, yet it is impossible to vindicate the lofty tone and irritating proposals expressed in the answer of the British government. When Mr Addington's administration concluded the peace of Amiens in 1801, Mr Fox, always consistent in pressing the spirit of pacification, joined with Mr Pitt in approving, or rather accepting the peace, as the best that could have been expected. Indeed, however just we may regard the war in its commencement, it can scarcely be denied, that Mr Fox faithfully pointed out several important errors in its progress, and in many respects gave good advice to his country. But his invariable and inveterate opposition to almost every measure of the administration, occasioned many of the truths which he uttered to be heard by many with nearly as invariable and inveterate prejudice. Upon the renewal of war in 1802, Mr Fox spoke with great eloquence in support of peace; and must be allowed to have shewn, that, however clear our grounds of complaint against the conduct and designs of the French ruler, the direct and instant appeal to arms was neither justified by sound policy, nor enforced by strong necessity. The friends of Mr Pitt, of Mr Fox, and of Lord Grenville, having concurred without any plan of junction, in denouncing the inefficiency of the military system of the government, the prime minister announced his intention to withdraw from office; and Mr Pitt recommended to the king the formation of a ministry on the broadest basis; but the mind of the sovereign was decidedly adverse to the admission of Mr Fox, who, together with Lord Grenville, continued in opposition. Upon the death of Mr Pitt, however, and in the difficult circumstances of the country at that time, his Majesty does not appear to have testified any reluctance to Mr Fox's appointment as foreign secretary of state; who, on his part, now advanced in years, and declining in health, can scarcely be considered as having been actuated in his acceptance by any views of personal ambition. One of the first acts of his administration, the introduction of the Lord Chief Justice into the cabinet, was made the subject of complaint in parliament; and such a measure, however vindicated by the right of prerogative, can scarcely be reconciled either with the views of expediency, or the principles of the constitution. In regard to foreign politics, the new government could not easily alter the course adopted by their predecessors; and Mr Fox therefore deemed it the most advisable plan to cultivate the connection, which still subsisted between Great Britain and the continental powers, and especially to draw a firmer alliance with Russia. In his financial measures, he adhered still more closely to those of his predecessor; and his increase of the property tax from 6½ to 10 per cent. was obviously rendered necessary by the state of the country. His military plans, which consisted chiefly of the training bill, and the conversion of the service of regulars for life into service for a term of years, though both of them commendable in their principle, and calculated to produce the best effects, were nevertheless obviously inadequate to supply that great and immediate addition of strength, which all parties had acknowledged to be wanting in present emergencies. His measures respecting Ireland, also, varied very little from those of Mr Pitt; and the Catholic claims were advised to be postponed. The public money, however, was not so lavishly applied to foreign subsidies; a milder exercise of power is understood to have taken place in Ireland; the interests of liberty were protected by the limitation of military service to a term of years; and, above all, the abolition of the slave trade, is sufficient of itself to immortalize the administration of Mr Fox and his friends. With these, and a few other exceptions, it must be admitted, that the change which had taken place, was more of men than of measures; that the new ministry made nearly the same apologies for the increase of public burdens, which their predecessors had used; and that the new opposition displayed nearly all that hostility and asperity towards administration, which they had condemned in the old. There is much justice, indeed, in what has been alleged by the friends of Mr Fox, that many things censured by him in the conduct of former ministers, could not, when done, be easily altered; and that it was only by the gradual application of better principles, that any great amelioration could be effected in public affairs. Yet there can be no doubt, that many of his previous admirers were seriously disappointed, in perceiving so little apparent effect produced by his exaltation to power; and it can scarcely be denied, that these expectations, though unreasonable in themselves, had been too much encouraged by his general conduct in opposition. His administration, however, was too short in its duration to afford a full opportunity for the exertion of his talents, and the application of his principles. His declining health, also, when he entered upon the labours of office, must have contributed materially to enfeeble his hopes of accomplishing much as a public leader; and it is probable, that the prospect of being able to conclude an honourable peace with France was one of his principal inducements to accept the anxious and arduous station of a British premier. The negociation for this great object, the last act of his political life, commenced in 1806, and originated in his indignant rejection of a proposal to assassinate the Emperor of the French. As a general basis for negociation, he recommended "a peace honourable for both parties and their allies, and calculated to secure the tranquillity of Europe; and, as a more specific ground of the intended treaty, the French government verbally agreed to the principle of *uti possidetis*. But new objects of ambition arising to the French, and the health of Mr Fox rapidly declining, they departed from their verbal professions, and, with many personal compliments to the British Secretary of State, and a little rudeness to the British plenipotentiary at Paris, terminated the negotiation.

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* The great question in deciding upon the origin of the war with France, is simply this, whether the dangers to which this country was exposed from the hostile encroachments and revolutionary views of the French rulers, were sufficiently great and evident, to warrant our preparations against them; and whether the wisdom of these preparations was or was not counterbalanced, by provoking the declaration of hostilities on the part of France. We refer to the speech of Mr Pitt in the House of Commons, on the 12th of February 1793, and to that of Mr Grey in the House of Lords on the 21st of that month, as containing an authentic view of the arguments of both parties.

We have been unwilling to interrupt the preceding sketch of Mr Fox's public career, by adverting to the history of his private life; and there is little space left for more than a few slight notices on the subject. The irregular habits of his earlier years were not forsaken in the bustle of political contests; and, at one period, involved him in the greatest pecuniary difficulties, from which he was extricated by the subscriptions of his friends, upon the express condition of withdrawing his attendance from the gaming table. His better judgment seems to have condemned the immoral courses in which he engaged, and into which he appears to have frequently been drawn by unworthy associates, whom his indolent good nature, and easy urbanity, admitted too freely into his friendship. He gave proof of a taste for purer pleasures, by the ease and alacrity with which, at seasons of occasional leisure and retirement, he recurred to literary pursuits and epistolary compositions. Even in his youth, when the marriage act was under the consideration of parliament, he gave a public testimony to the miseries of a dissolute life; and, on several other occasions, clearly shewed, that he did not approve the lax morality of the French philosophy. Though deficient, therefore, in practice, in a degree not to be justified, and particularly to be lamented in a character so distinguished in other respects; he ought not to be regarded as having been, upon principle, a mere dissipated man of pleasure. His marriage, which was first announced in 1802, though said to have taken place in 1780, may be considered, it has been justly observed, as "a homage which he paid to virtue;" and his later years were spent with little interruption in the simple enjoyments of domestic life, or in an assiduous attendance on public duty. When residing in his favourite retirement at St Anne's hill, as stated by one of his biographers, he usually rose before eight o'clock in the morning; breakfasted, and read the newspapers; perused some Italian author with Mrs Fox; spent an hour or two in study; sat down to a frugal but plentiful dinner at three or four; drank a few glasses of wine, followed by coffee; walked or conversed till tea-time; employed the evening in reading, or listening to the reading of history, till near ten; and concluded the day with a slight repast of fruit, or of something equally trifling. When residing in town, he generally went to his office at eleven o'clock, where he remained until three; and, as long as his health permitted, continued to bestow the most punctual and active attention upon his duties, frequently even directing in person the more minute transactions of his department. About the end of May 1806, his health was visibly affected, and his disorder was pronounced to be of a dropsical nature. On the 7th of August, he underwent the operation of tapping; and, for several days after, was considered to be in a very hazardous state. He requested to be removed to his residence at St Ann's Hill; but with difficulty reached the house of the Earl of Devonshire, at Chiswick, where a second tapping was performed on the 30th of August. After the operation, he experienced a temporary revival; but, in a few days, every hope of his recovery vanished, and his friends were permitted to take their leave of him. During his illness, he is said to have expressed an anxious wish that he might live to witness the abolition of the slave trade; and he left it as his dying charge to his political friends, that they should persevere in their efforts for the accomplishment of that glorious object. In his last moments, he put the hand of Mrs Fox into that of Lord Holland, and then, placing his own upon theirs, "God bless you," he said, "I die in peace: I pity you." These are reported to have been the last words which he uttered; and he expired on the 13th of September 1806, in the 59th year of his age.

At a time when even Mr Fox's nearest relatives and warmest friends have declared that insuperable objections exist to a memoir of his life, it is no easy task to offer even an obscure and unpretending sketch of his character; and, were there not some approved and experienced guides to point out the leading marks, we should never have attempted the outlines of such a portrait.

Mr Fox, in his person, was rather under the middle stature; and, though celebrated for agility in his youth, was of a corpulent habit during the greater part of his life. His chest was capacious, his shoulders broad, his hair dark and thick, his complexion dusky, his eye-brows black and bushy, and his countenance, especially in the course of argument, peculiarly animated and expressive.

In his political life, he had been so constantly and eagerly engaged in compassing the overthrow of ministry, that he will probably appear, to every indifferent observer, more in the character of a determined party-leader, than of an enlightened statesman; and yet it may be doubted whether his ardent attachment to the political body of which he was the head, did not proceed as much from the warmth of his friendship, as from the spirit of party. This consideration may at least account as honourably as most others for the unquestionable fact, of his having consented, in the course of his public career, to join every one of those whom he had systematically opposed; and which, though it will not exempt him from the charge of inconsistency, may vindicate his name from the more heavy reproach of insincerity. He was almost uniformly the undaunted champion of constitutional freedom; and it can scarcely be doubted, that his resolute resistance to the slightest encroachments of government may have often acted as a salutary restraint. Yet, in some instances, he was opposed not merely to the popular cause, as in the case of Mr Wilkes, but even to the principles of liberty, as in those of the Regency Bill, and the admission of the Chief Justice into the cabinet. As a speaker in Parliament, Mr Fox stands in the first rank; and, though originally the pupil of Mr Burke, he soon displayed more commanding powers. He was more vehement in manner, more forcible in argument, more consummately master of the science of debate. He sometimes hesitated in the commencement of a speech, frequently indulged in digressions, and occasionally even in repetitions, or gave loose to a flow of popular declamation, instead of senatorial reasoning; but he was always fluent when his feelings were roused, and was able, with the utmost skill, to tread back his steps, when hard pressed, without seeming to retreat from an untenable position, or to return from an unnecessary digression. Whatever became of his subject, he bent his whole force to trample down his enemy; and exercised a degree of talent in parliamentary warfare which has never been rivalled. He was equally prepared to perplex his adversary by ingenuity, to overawe him by violence, or to overwhelm him with a torrent of eloquent abuse. He is acknowledged to have been peculiarly successful in reply, never failing to take advantage of the concessions or contradictions of his opponents, and to turn upon them with their own weapons. "I knew him," says Mr Burke, in a pamphlet written subsequently to their separation, "when he was nineteen; since which time, he has risen by slow degrees to be the most brilliant and accomplished debater that the world ever saw."

In the accomplishments and endearments of private life, Mr Fox's character was peculiarly attractive; and he was at all times remarkably beloved in the circle of his friends. He was frank and unassuming in manners, kind and gentle in dispositions, and, according to those who knew him best, possessed even the simplicity of a child. "He was," says Sir James Mackintosh, "gentle, modest, placable, kind, of simple manners, and so averse from parade and dogmatism, as to be not only unostentatious, but even somewhat inactive in conversation. His superiority was never felt, but in the instruction which he imparted, or in the attention which his generous preference usually directed to the more obscure members of the company. His conversation, when it was not repressed by modesty or indolence, was delightful. The pleasantry, perhaps, of no man of wit had so unlaboured an appearance. It seemed rather to escape from his mind, than to be produced by it. His literature was various and elegant. In classical erudition, which, by the custom of England, is more peculiarly called learning, he was inferior to few professed scholars. Like all men of genius, he delighted to take refuge in poetry, from the vulgarity and irritation of business. His own verses were easy and pleasing, and might have claimed no low place among those which the French call *Vers de Societé*. He disliked political conversation, and never willingly took any part in it. Perhaps nothing can more strongly prove the deep impression made by this amiable part of his character, than the words of Mr Burke, who, in January 1797, six years after all intercourse between them had ceased, speaking to a person honoured with some degree of Mr Fox's friendship, said, "To be sure, he is made to be loved;" and the emphatical words were uttered with a fervour of manner, which left no doubt of their heartfelt sincerity. From these qualities of his private, as well as from his public character, it probably arose, that no English statesman ever preserved, during so long a period of adverse fortune, so many affectionate friends, and so many zealous adherents.

Mr Fox was distinguished from his youth as a literary character; and various productions of his pen attest the elegance of his taste, and the accuracy of his classical attainments. His compositions, while at Eton, his fugitive poetry, and several of his speeches; his

"Letter to the Electors of Westminster," published in 1793, upon the composition of which he is understood to have bestowed considerable attention; his correspondence with Mr Wakefield, which evinces an intimate and critical acquaintance with the Greek and Roman writers; a few letters to Mr Trotter, published in the Memoir of his life by that gentleman, which furnish additional specimens of his exquisite taste, and amiable benevolence; and especially his "History of the early part of the Reign of James II.," left unfinished, and published after his death, remain as monuments of his distinguished talents, and testimonies of his relish for the pleasures of taste. To the introductory chapter, prefixed by Lord Holland to the last mentioned work, we must refer our readers for more minute information respecting the private studies and literary opinions of this distinguished person.

The sentiments of this great man on the subject of religion have unhappily been stated in a manner so contradictory, as almost to warrant the conclusion that they were not very determinate. One of his warmest admirers, who enjoyed much of his intimacy, during the last eight years of his life, who attended his sick-bed, and witnessed his last moments, positively affirms Mr Fox's belief of Christianity, and denies that he ever heard him utter a single expression, or give the slightest indication of doubt or disbelief of its truth. At the same time, while he describes Mr Fox's whole demeanour during his painful illness, to have been expressive not of stoic hardihood, but of patient resignation to Divine Providence, he has not recorded any direct allusion, in his friend's conversation, to one Christian principle of faith or hope. He is reported to have said to one of his friends, "What do you think, my Lord, of the state of the soul after death?" and to have proceeded to observe, "I should have believed in the immortality of the soul, though Christianity never had existed; but how it acts, when separated from the body, is beyond my capacity of judging. This, however, I shall know by Christmas." One thing is certain, that both in private life, and whenever he touched upon religious topics in parliament, he uniformly used the language of reverence, and shewed that he held sacred the right of private judgment in religion; avoided giving offence to religious feelings, or even prejudices, and testified respect to every scruple on the subject, which was truly conscientious. "On the score of religion," says Mr Trotter, who describes Mr Fox's demeanour in his continental tour, "I perceived that he did not merely *tolerate*, for that word ill applied to his disposition on sacred matters, but was truly *benignant*, for he conceived that all human beings enjoyed the exercise of religious worship, and the self-possession of religious opinions, as a matter of right, not to be controulled by their fellow men; that inoffensive and good citizens did not require the permission of others for this mental enjoyment, and that all were entitled to honour the Deity in a decent and pious manner, without reflection or reproach. There never escaped from his lips one disrespectful word regarding religion; never one doubtful smile was seen in his countenance in a place of worship, or the slightest derogation from a solemn and respectful regard for all around him." See Mr Fox's correspondence with Wakefield; introductory chapter by Lord Holland to Mr Fox's *History of James II.*; Trotter's *Memoirs of the latter Years of Mr Fox*; and Life of Mr Fox, in the *Christian Observer*, vols. vi. and vii. (*q*)

History.

FOX ISLANDS. A great chain of islands stretches across that part of the North Pacific Ocean bounded by the peninsula of Kamtschatka on the Asiatic continent, and that of Alaska in North America. The first of these towards the west, was discovered in the earlier part of the eighteenth century, by Capt. Vitus Behring, a Dane in the Russian service, and named after him; and the second, twenty-seven miles from it to the east, was called Copper Island. Both were greatly frequented by the Russians, on account of the valuable furs obtained from the animals of the surrounding seas; and a company of adventurers from Kamtschatka having prosecuted farther discoveries, ascertained, in the year 1745, that other islands lay farther to the east. Having wintered on one of them to kill sea otters, they continually advanced farther on; and after various successes and discomfitures, at length, by means of intermediate islands, reached the American continent. This chain was known by different appellations bestowed on certain groups of it, which the progress of discovery proved were only a short way detached from the rest; and they were in general divided into the Aleutian, Andreanovi, and Fox Islands: but late navigators are disposed to include the whole chain under the name of Aleutian or Fox Islands; while it is sometimes proposed, though without any apparent good reason, to except Behring's and Copper Island from the number. It is not difficult to anticipate, however, that this separation will soon be abandoned. The Fox Islands in position resemble a circular arc, extending from 165° to 195° of longitude east; the most southern island lies in about 53° of north latitude, and the most northern, at each extremity, in 55°. These islands are of all different sizes, below 104 miles in length, which is that of Behring's Island, and are divided by channels of very unequal width. This last is 192 miles from the harbour of St Peter and St Paul, in Kamtschatka. Copper Island, which is mountainous, and twenty-five miles long, lies due east, and is the first of the Aleutian, or Fox Islands, properly so denominated. Attoo is 60 miles in length, and 188 miles from Copper Island: Next is Agattoo, twenty miles distant, and six in length; then Buldyr, an oval rock, six miles by ten, distant 70 miles; and so on, regarding the rest, to Omnak, Oonalashka, and Oonemak, next to Alaska. Some of these islands are disposed in clusters; and although the number of the Fox Islands was originally calculated at sixteen, many more are now included. Indeed, to judge by recent occurrences, they appear to receive accessions: In the year 1795, a thick fog having obscured a rock which was the favourite resort of the Aleutians in their hunting excursions, thirty miles north-west of Oonalashka, they found the sea, on approaching it, in a state of ebullition, and vast quantities of vapour rising around. Concluding that it was haunted by evil spirits, no one would again venture thither during the lapse of five years, when a few more courageous than the rest, ascertained that a volcanic island had sprung up, discharging fire and smoke from a crater in its summit. In the year 1806, this island had augmented to about twenty miles in circuit; lava flowed from it down into the sea, and the heat was so great as to preclude landing on that particular side. There are always some volcanoes in activity among these islands; and others, once known to have blazed, are now quiescent. Earthquakes are common from such subterraneous fires, and the concussions are violent. Huts were thrown down in 1802, when a long-extinguished volcano in Oonalashka began to burn, and the flames from the new erupted island ceased; but they were renewed soon after. The Fox Islands are of barren aspect; the mountains are conspicuous, being in general high and conical, and covered with snow during a great portion of the year. Nothing is produced in the whole course of the Aleutian chain, except low shrubs and bushes. There are no trees; but, to compensate for this defect, recourse is had to drift wood, often of large size, floated on shore from America and other countries by the tides. The lower vallies produce abundance of fine grass, but the islands are destitute of cattle; and there are different indigenous roots, as also potatoes, recently introduced by foreign settlers, which afford subsistence to the inhabitants. Berries are collected, and laid up for winter provision.

Fish.

Considerable variety of fish frequent the surrounding seas, such as whales, salmon, cod, herring, and holibut, of such enormous size as to weigh several hundred pounds. These are not common food, but they are cut to pieces in the water when caught, from being too heavy for the frail canoes of the natives. On their first discovery, the Russians found innumerable phocæ, from which they obtained valuable furs; and for many years they continued to kill thousands of sea otters, whose skins bore a high price at that time, and still higher now, because, from unceasing pursuit, their numbers are wonderfully diminished. Not above two or three hundred are at present taken annually, whence their total extirpation in a short time is anticipated. But others are of even greater importance to the inhabitants, which are as ardently sought as the sea otter is by strangers. Of one particular seal they eat the flesh; oil is extracted from its fat, which serves to illuminate and warm their huts; the sinews are fashioned into thread; clothes, shoes, and household utensils, are made of its skin; its paunch blown up, is used for holding liquors; and the œsophagus is fashioned into boots, impenetrable by water. Nor is this all, for the thin membrane of the entrails is converted to a substitute for glass, in admitting light to their subterraneous habitations; and the whiskers are composed into plumes for ornamental head-dresses.

Birds.

The feathered tribes, particularly the aquatic kinds, are also numerous here, such as wild geese and wild ducks, which are caught in spring, and salted for winter provender. Some of the rocks afford a retreat to gulls and auks during the breeding season, when their eggs are collected and preserved for the same purpose. Eagles, partridges and buntings, are among those found always on shore, and there are some species migratory.

Quadrupeds.

When the Russians first discovered the Aleutian chain, they obtained the skins of foxes still more easily than those of the sea otter, and yearly carried away many thousands. These animals were so abundant on the Fox Islands, when restricted to a smaller portion of the chain, that they thence received their name; and Steller, an ingenious naturalist, who wintered on Behring's Island, has left an interesting description of the habits of those found there. But from the same unremitting destruction, they are now almost as much reduced in proportion as the sea otter, which has induced the huntsmen to extend their snares still farther east. Foxes and mice are the only indigenous quadrupeds which the later visitors have observed here; but settlers have endeavoured to introduce hogs at Oonalashka, and, for want of other food, have supplied them with fish. This is said to render the fat thin and oily, and to impart a disagreeable fishy flavour to the flesh. The same has been the case with poultry fed on dried fish, which the Russians have likewise attempted: the fat becomes oily, and the flesh soft and spongy.

Inhabitants.

The natives of the Aleutian Islands are of middle size, of a very dark brown and healthy complexion, and resembling an intermediate race between the Mongul Tartars and North Americans. The face is in general round; the nose broad, small, and compressed; the eyes black; and the hair, which is strong and wiry, of the same colour. That of the men is cut short; by the women it is likewise cut short before, and made into a club on the back of the head. The latter are rather handsome, and very complaisant. Both sexes, unlike uncivilised nations, are clean in their persons; and their features, which are strongly marked, have an agreeable and benevolent expression.

Tattooing.

It is singular, that among the greater part, if not all the savage tribes with which Europeans are acquainted, some artificial disfiguration of the body is accounted ornamental. The Aleutian females practise tattooing, particularly of the upper lip, neck, arms, and chin: punctures are made in the flesh, and a sort of coal-dust or charcoal rubbed in. By this means, while the men carefully eradicate their beards, the women, by the bluish tinge, exhibit the appearance of having acquired one. But from the Russian settlers explaining to the younger females, that they they do not esteem these ornaments as any accession to their beauty, tattooing has rather been brought into disrepute, and is now on the decline. However, they still practise a custom much more tedious and deforming, in the perforation of the under lip, into which bones suspending beads and other trinkets are inserted, while the whole are retained by a kind of button in the inside of the mouth. Here, in like manner, the settlers have found means to signify to the Aleutian females, that their beauty is not embellished by it, and the custom is daily decreasing. The ears of the women are perforated all around with holes, to which beads are suspended; and the nose of the men is likewise perforated to receive a piece of wood or bone the size of a small quill, to which strings of glass beads are hung on solemn occasions.

Dress.

There is little difference in the external clothing of either sex, the upper garment being a kind of frock or surtout, called *parka*, made of seal-skin, and formerly of that of the sea-otter, or of the skins of birds. Though simple in form, it is often neatly and variously ornamented; and the seams figured with stripes of thin leather, ingeniously worked or dyed of gaudy colours, or long white goats hair, brought hither as an article of trade from Siberia. So much care and attention is bestowed on one of these frocks, that sometimes a whole year is occupied in completing it. The Aleutians have besides a kamleika, or rain garment, made of the entrails of the seal, which, being of a membranous substance, excludes the water; and although the pieces are only three inches broad, the whole are so neatly united, that the kamleika, though exposed a whole day to rain, is never penetrated. The exterior part of the Aleutian costume is now undergoing some change, by the substitution of coarse cotton, or sail-cloth. One of the most important parts of dress is a wooden hat fashioned so as to project over the eyes like an umbrella. The material composing it is not only extremely scarce, but difficult to be formed into any shape with the rude and imperfect tools of the islanders. After obtaining a thin plank, by laborious reduction, its ends are drawn together, and secured with tendons, an operation always difficult and of uncertain success. It is then painted with red ochre, which is procured from the different volcanoes, and ornamented with ivory, glass, amber, or above all with the bristles of the beard of the sea-lion. The last are particularly prized; for, in addition to their rarity, possession of a number proves the owner to be a skilful huntsman, as each animal has only four: and a recent voyager, who acquired one of these hats, adorned with the whiskers of 37 sea-lions, acquaints us that it was valued at 80 rubles, or above £10 sterling, among the islanders. The women for the most part go barefooted, and wear bracelets just above the ankle joints, and also on the wrists; they are besides very fond of rings on the fingers. Both sexes entertain a great partiality for amber ornaments; but nothing is so much esteemed among them as long tapering shells, called *sea-teeth*, which, indeed, were in such request, that during their days of greater affluence, they did not scruple to give three or four sea-otter skins, that is goods worth more than £12 sterling at that time, for a small string of them, and what would now be quadruple the sum.

Dres.

gion.

The natives of the Fox Islands have very obscure ideas of religion: they believe in kugahs or demons, whose evil offices they seem desirous of averting; and ever since being subjected to great inconvenience and distress by the tyranny of their Russian visitors, consider those of the latter more powerful than their own. Apparently they worship idols; and they were accustomed, at an annual dance or festival, to wear masks neatly and fancifully ornamented, which are now reported to be laid aside. Many have been baptized after the ceremonies of the Greek church, professed in Russia.

age.

Marriage, in the proper acceptation of the term, does not exist here; a man takes as many wives as he can maintain, and these are purchased from their parents. Should the purchaser repent of his bargain, the wife may be returned, when he must restore part of the value received with her; or should his prosperity decline, he may part with the whole of them successively, and they are at liberty then to seek other husbands. Instances occur where the same woman has two husbands at once, who adjust the terms on which they are mutually or respectively to share her society; and it is even not uncommon for men to make an exchange of their wives. Whatever virtues these people may possess, they are grossly deficient in that great principle of morality, which binds the affection of the two sexes to each other. Handsome boys are brought up like girls, dressed and tattooed in the same manner, and instructed in all the arts practised by women for the gratification of men. These miserable and degraded wretches are denominated schopans, and what is singular, no means have ever been taken to diminish their numbers.

Among the barbarous customs formerly practised by the Aleutians, was slaughtering slaves of both sexes, at the funeral of their deceased chiefs. This is now totally discontinued. Men and women are differently treated; sometimes the bodies of the former are partially embalmed with dried moss and grass, and interred in their best attire, along with their arms and other implements, while the tomb is adorned with coloured mats, embroidery, or painting; but the latter are treated with no such formalities. A mother will keep her deceased child embalmed in her hut during several months, always wiping it dry, and consenting to its inhumation only on the commencement of putrescence, or when she can be reconciled to the separation.

Dwellings.

The Aleutians dwell in excavations of the earth, the sides of which are lined with beams or poles of drift-wood washed ashore, inserted to support a roof formed of similar materials. These excavations are from 20 to 40 yards in length, and between six and ten in breadth; earth is thrown over the roof, which affords a soil for vegetation, so that after the habitations have stood some time, and are overgrown with grass, an Aleutian village bears no imperfect resemblance to an European church-yard. Fifty, or even an hundred and fifty individuals, dwell in the different divisions of the hut, which is lighted by a small window covered with the membranaceous intestines of the seal, or with dried fish skin; and into which they descend by an aperture that at the same time gives egress to the smoke. But little cold is felt within, and their habitations are seldom heated with fire. Travellers affirm, that they are so warm that the inhabitants sometimes sit naked in them. Their different divisions are made by partitions of seal skin.

Canoes.

As the chief subsistence of the Aleutians is derived from hunting and fishing, a large portion of their time is devoted to these pursuits; and the greatest display of their art is in the construction of their canoes and weapons. The former are remarkably neat, consisting of a wooden frame covered with leather, and in the inside is a hole to receive the body of the navigator sitting, around which a seal skin is so tightly drawn as to exclude the water. In general, this vessel contains only one person, sometimes two, and rarely three. The length of the first is about eighteen feet, the breadth nearly two feet, and the depth eighteen inches, lightly yet firmly made, and capable of withstanding a considerable sea; insomuch, that an Aleutian, in moderate weather, can paddle his baidarka, as it is called, ten miles an hour, and can retain his seat in security, while his breast is washed by breakers. Neither is much apprehension excited by storms; for several baidarkas, when bound together, easily resist the waves. Billings, a late voyager, speaking of these vessels, exclaims, "If perfect symmetry and proportion constitute beauty, they are beautiful: to me they appeared so beyond any thing that I ever beheld. I have seen some of them as transparent as oiled paper, through which you could trace every formation of the inside, and the position of the natives sitting in each, whose light dress, painted and plumed bonnet, together with his perfect ease and activity, added infinitely to its elegance." The beauty and construction of the baidarka are the subject of great emulation among the islanders. They have another large open boat, called a baidar, capable of holding fifteen or twenty people, which was formerly the common property of a village, but all of them are now in possession of the Russians.

Should a whale be discovered, the Aleutians follow it in their canoes, and watch the opportunity of raising its head to breath, to pierce it with a dart near the pectoral fin; then retiring while the animal grows faint with the loss of blood, they revisit the spot frequently in the course of the day, until at length, finding it dead, they tow it ashore. The right of property is determined by the point of the weapon which occasioned the mortal wound; a fact not difficult to ascertain, as all their implements have a particular mark. But the Russians always claim half of the whole fish. These darts, which are about four feet and a half long, are feathered; some are coloured red, some black, and fashioned differently for the different animals against which they are to be directed. They are thrown with much force and precision, along a small board held horizontally, to the distance of sixty yards. They have likewise lances, bows, and arrows; but warfare among them is now unknown.

Manufactures.

The Aleutians shew much neatness and dexterity in their different works. Besides the fabrication of arms and baidarkas, the men occupy themselves in carving diminutive figures of terrestrial or aquatic animals from the teeth of the sea cow, which are much harder than common ivory; and the women are engaged in making fine mats, little baskets, and pocket-books of straw, particularly during the long winter evenings. The latter are woven together with so much regularity, and in such symmetrical figures, that they might be supposed the work of European artists. They also dye various ornamental substances, as straw and leather, of fine and florid colours, with very simple materials.

Though reputed savages, the Aleutians are far from being deficient in capacity: they are mild, polite, and hospitable; and, in their intercourse with Europeans, are diligent and submissive; but, if roused by offence or maltreatment, they become rash and malevolent, regardless of all danger, and even expose themselves to certain destruction.

Amusements.

Dancing to the tambour or drum, with an accompaniment of pebbles rattled in a blown bladder, is here a favourite amusement, which is free from those lascivious gestures usually seen among barbarous tribes. Both sexes, clothed in their best attire, with richly ornamented head-dresses, join in the dance; but the masks which they formerly wore on such occasions are said to be laid aside. An amusement among the young men of the island of Tanaga, consists in leaping from the skin of a large sea lion held up and stretched out by some of their companions, from which they spring to an astonishing height. Their love of snuff and brandy is very strong; and they will be content to labour a whole day for a single leaf of tobacco, which they contrive to grind to powder, adding a mixture of ashes and water.

Population.

Many islands of the Aleutian chain had a very considerable population, when originally visited by Europeans; but the people, along with the animal tribes, have been continually declining. Between the years 1750 and 1760, the inhabitants of Oonalashka were calculated at several thousands; the males of the whole islands were judged not to exceed 1100 or 1300 about the year 1790; but, in 1806, their number was supposed to be reduced to 300. Probably there was a large preponderance of females, owing to various circumstances in their mode of life. Northern nations are seldom populous; and, with few exceptions, nature seems there to be alike hostile to animal and vegetable increase. It is the oppression, however, which the Aleutians have suffered ever since they became first acquainted with Europeans, that has progressively diminished their numbers. At first, they ventured to resist the usurpation of the Russians; but they were speedily subjugated, and are now held in a state of abject slavery. Their islands are resorted to solely for the profit and convenience of their invaders, to whom they pay a tribute in furs; and they have admitted of permanent establishments upon them, which send out parties of hunters, who compel the attendance of the natives. Sometimes, in the plenitude of their authority, they dispatch the hunters to distant islands, from whence many of them never return, or carry them to the continent of America, where the animals have hitherto had a wider range to escape destruction. Formerly, on arriving from Ochotsk or Kamtschatka at any of the inhabited islands, the Russians were accustomed to take a few inhabitants as hostages for their security; but now they assume possession of a village as if it belonged to themselves; distribute their traps, to be employed by the men in catching foxes; select such women as please them best; and exercise a most despotic sway over the whole. Yet the state of their hunters is represented as very miserable. They are engaged by a trading company, which pays them little regard; they remain eight or ten years together among the Fox Islands, suffering hardships and dangers, and so much exposed to the ravages of the scurvy, that not many survive to revisit their native land. See Forster's *Voyages in the North;* Coxe's *Russian Discoveries;* Cook's *Third Voyage*, vol. ii.; Billing's *Geographical and Astronomical Expedition;* Langsdorff's *Voyages and Travels.* (c)

FOX. See Hunting and Mammalia.

FOYERS, Fall of, a celebrated and most beautiful cataract in the Highlands of Scotland. It is situated in the county of Inverness, and district of Stratherrick, 19 miles south-west of Inverness, and close by the military road from thence to Fort Augustus. It is on the river Feaghlin, a mountain stream of considerable magnitude, which, after a rapid course of about seven miles in a northerly direction, through the rugged track of Stratherrick, precipitates itself into Loch Ness, on the south-eastern side, about half way betwixt the eastern and western extremities of that noble lake, at the romantic seat of Mr Fraser of Foyers.

This cataract is about a mile from the brink of the lake, the banks of which rise so suddenly, that the perpendicular height from its surface to the fall is not less than 300 feet. The river at the commencement of the fall becomes narrowed, by the closing of the rocks on each bank, to little more than seven or eight feet. It thence shoots forth in tremendous impetuosity over a precipice of smooth, black granitic rock, forming an uninterrupted, and almost perpendicular water fall of 165 feet from its commencement to the surface of the pool below. The chasm, or gully, into which it descends, is of a circular form, about 50 or 60 feet diameter at the bottom; its sides are wooded and rugged, and formed in many parts of rock quite perpendicular, or nearly so, and of great extent, towering on each side of the river to the height of 350 feet above the surface of the pool, that is, 100 feet above the commencement of the cataract.

The station where the best view is to be had of this superb fall, is a projection of rock, which, on the east side of the river, extends across it so far as to bring the spectator directly opposite the face of the cataract. But this projecting rock is still 80 feet perpendicular above the bottom of the fall; nor is it practicable to have a view of it from a lower station. The upper surface of this rock is covered with grassy turf, which, from its being incessantly bedewed with spray, is ever fresh and vegetating, and has from thence obtained the name of the Green Point.

When the river is swollen after rain, on the melting of the snows on the southern mountains, the quantity of spray raised is so great, that the above-mentioned station cannot be occupied with safety; such floods of water being thrown upon it, as will in a moment thoroughly drench, or perhaps sweep away the adventurous spectator. On such grand occasions, incessant torrents are seen to flow down all sides of the immense circular basin into which the water falls; a strong current of air is forced up from the bottom, and seems to agitate the water, as it pours from the rocks or the bushes on their surface, and to raise a cloud of spray into the atmosphere, distinctly visible at the distance of 10 or 15 miles, and not less in height than 600 or 700 feet. The writer of this article has frequently, on such occasions, seen a most beautiful rainbow formed by it, occupying a complete segment of the heavens as in an ordinary shower of rain. The inverted rainbow is also very beautifully seen at the bottom; but this fine phenomenon is observable only when there is less water in the river.

The water of this river is very strongly impregnated with moss or peat earth, so that its colour, when descending the cataract, is pretty nearly that of porter drawn from a cask; but no sooner does it strike the surface of the pool, than it flashes of the most brilliant whiteness, as if it were bursting forth into a flame, or like bluish smoke issuing from a kindling mass of wettish straw.

It has been suggested by some, and perhaps not without probability, that this conspicuous fall has given name to Loch Ness: for in the Gaelic, or Erse language, *ess* signifies a water-fall, and *Loch-an-ess* is the *Loch of the fall*. This is to us more probable than that *ness* should come from the Danish or Saxon word *nese*, signifying nose or promontory, which has undoubtedly given name to many places on the sea coast of this island. For what propriety would there be in applying this word to Loch Ness? It is not a nose or projecting promontory like *Caithness*, *Buchanness*, *Fifeness*, and many others.

It is worth any person's while who inspects this cascade and its scenery, to ascend to the bottom of the large gully, about 100 yards farther down the river than the fall. He will there see masses of rock tumbled on one another of a size which, by viewing them from above, he had probably little conception of, and behold nature in an aspect of wild and indescribable magnificence, beyond what even poets usually represent.

About half a mile farther up this river, is another very fine waterfall, 37 feet high, nearly perpendicular, and also uninterrupted. A bridge is thrown across the river, immediately below this fall, and the height from its ledge to the water is 60 feet. These measurements, as well as those given of the great fall below, were taken by the writer of this article, with all possible accuracy, by a line. He had the opportunity of attending particularly, for several years, to the sublime phenomena of the Fall of Foyers. (*x*)

FRACTIONS. See ALGEBRA and ARITHMETIC.

FRACTION, *Greater* (F), in Music, is an interval discovered, and so named, by the indefatigable Mr Marmaduke Overend: its ratio in numbers is

$$=\frac{4,946,832,462,181,367,513,427,734,375}{4,951,760,157,141,521,099,596,496,896}=\frac{3^{39}.5^{13}}{2^{92}},$$

=Σ—f+m, =VIII÷612—.1845740×Σ; which last shews the small error, in some cases, of its *artificial comma* 1; its common logarithm = .9995793,8935, = .001397238×VIII, = .0779626×c, = .85820144×Σ, which last is its regular expression in our new notation. Its value in tuneable or concordant intervals is 27 4ths — 12 V — 18 III, by which it might, according to theory, be tuned; above the tenor cliff C, of 240 vib. it would *beat* .23258 times per 1″, or 23¼ times in 100″.

The value of this interval, in all the several other intervals enumerated in Plate XXX. in Vol. II. may be seen from the following simple equations, viz.

F=d+2f

F =Σ + m —f
=R + d —5Σ
=3Σ+ m —r
=4Σ+ m —χ
=€ + 2f —3χ
=c + m —ϕ
=11Σ+2 m—ϕ
=15Σ+2 m—D
=ϕ + R —π
=L + f —3π
=27Σ+3 m—∂
=16S+ ƒ —9T
=17S+ 2S —10T
=2t +15S—10T

=6€ — B —Σ
= ϕ — 2r —5Σ
= ϕ — 2f —9Σ
= c — ƒc —5Σ
= c — f —10Σ
= đ — f —11Σ
= π —2f—14Σ
= ℰ — π —5Σ
= 2ℰ — 𝒮 —5Σ
= 3ℰ — S —5Σ
= ∫ — ∂ —5Σ

F = t + d — 8c—5Σ
= t +16S— S —9T
= t +16S— 𝒮 —10T
=2t+16S+ S —11T
=T + d —9c—5Σ
=T + d —10c—5Σ
2F= ∂ — 3f —24Σ

F = R —5Σ
=VIII—18 S

F = € — ƒ€—5Σ
= € — χ—6Σ
= € — f —9Σ
=3€ — ƒ —4Σ

12F=53c—571Σ—12f—41m

½F= f +½d
⅓F=⅓R—Σ

FRACTION, *Medius* (d), is an interval, so named and marked by Dr J. W. Callcott (in the Overend MS. vol. ii. pp. 46 and 49), whose ratio is $\frac{50,000,000,000,000,000}{50,031,545,098,999,707}$, $=\frac{2^{16}.5^{17}}{3^{35}}$, =Σ—3f+m, =VIII÷612—.4447360×Σ, the error, in some cases, of its *artificial comma* 1; its common log. = .9997260,8915, = .000909912×VIII, =.05077095×c, = .5588795×Σ, which last is its regular value in our new notation. In tuneable intervals it is = 18 V+2 VIII — 17 VI, = 17 3rds+3 V—15 4ths; and above the tenor-cliff C (of 240 vib.) it *beats* .15142 per 1″, or 15⅐ beats in 100″, by which it may be tuned.

Its value in all the other intervals of our Table, are shewn by their symbols, as follows, viz.

d=R— R
=F+2f
=€—3χ

d= Σ+ m—3f
=10Σ+ m—3χ
= 5Σ+ F— R
= 3Σ+ P—4π
= 6Σ+7€—3ƒ
= 8c+ R— t
= 9c+ R— T
=10c+ R— T

d= R—2r— Σ
= R—2f—5Σ
= R— r— χ
= €—3f—9Σ
= €—ƒ€— R
=3€—ƒ —2r

2d=∂—7f—24Σ

½d=½F—f

d= ϕ— 4r— Σ
= ϕ— 4f— 9Σ
= ϕ— f— 3χ
= c— 3f—10Σ
= đ— 3f—11Σ
= D— ƒ€— 3χ
= D—2ƒ€— R
= π— 4f—14Σ
= π— ƒc— 3χ
= ℰ— π— R
=2ℰ— S— R
= ∫— 2c— 3χ
= 𝒮— ∂— 3χ
= L— 𝒮— 3χ
= S— S— 3χ
= P—4D— Σ
= P—4ϕ—17Σ
= ∮— P— 3χ

⅓d=⅓€— χ
= f—⅓Σ—⅓m
=⅓€—3Σ— f
=2⅓€+2Σ— ƒ

FRACTION, *Lesser* (f), is the smallest interval, except one (m), that is known; which was discovered, and so named and marked, by the late Mr Overend; and has

Fraction.

since been made the middle term of Farey's *Notation* of Musical Intervals, (see that article). Its ratio is $=\frac{450,283,905,890,997,363}{450,359,962,737,049,600}, =\frac{3^{37}}{2^{34}.5^{2}}, =0+f+0$ in the new notation by Σ, f, and m. It is $=\text{VIII} \div 612 - .85395446 \times \Sigma$, the latter term shewing the error that may arise from considering the *artificial comma* of this interval to be 1. Its common log. $= .9999266,5010$, $= .0000733,4990 \times \text{XVII}$, $= .000243663 \times \text{VIII}$, $= \text{VIII} \div 4104.029$, $= .01359582 \times c$, $= c \div 73.551994$, $= .14966096 \times \Sigma$, (which last is its regular value in the new notation,) $= \Sigma \div 6.681770$, $= 19.03501 \times m$, $= m \div .05253478$. In tuneable intervals it is = 21 4ths + 2 III — 16 V, = 24 4ths — 14 V — 2 3ds; and above the tenor cliff C (of 240 vib.) this interval will *beat* as an imperfect unison, .04054 per 1″, or near $4\frac{1}{18}$ times in 100″; but neither of which, or any other known method, except perhaps in the higher octaves, seems capable of tuning this nearly unappreciable interval.

The equations exhibiting the value of this interval, in terms of all the others in our Table, Plate XXX. Vol. II. are as follows, viz.

f = ½ F — ½ d
= r — 2 Σ
= 1⅔ r — ⅓ ƒc
= 2 r — ƒ€
= 3 r — 2 χ
= 5 r — 2 R
= χ — 3 Σ
= 4 χ — 3 ƒ€

f = Σ + m — F
= Σ + 2 r — ƒc
= 6 Σ + m — R
= R + 2 r — €
= 2 ƒc + m — φ
= Σ + φ — c
= R + R — c
= Σ + 𝔖 — 4 đ
= 2 Σ + P — 5 đ
= 4 Σ + S — 6 đ
= ƒ€ + φ — D
= ƒc + φ — ϖ
= c + φ — ε

f = € — R — 4 Σ
= € — F — 9 Σ
= φ — m — 10 Σ
= φ — d — 3 χ
= c — R — 5 Σ
= c — F — 10 Σ
= đ — R — 6 Σ
= đ — F — 11 Σ
= D — đ — 2 Σ
= D — c — 3 Σ
= D — € — 4 Σ
= ϖ — đ — 3 Σ
= ϖ — c — 4 Σ
= ϖ — € — 5 Σ
= ʃ — 2 đ — Σ
= ʃ — ε — 4 Σ
= ʃ — 2 € — 5 Σ
= ʃ — 2 m — 25 Σ
= 2 ʃ — 𝔖 — 3 Σ
= 2 ʃ — L — 4 Σ

2 f = F — d
= R — 5 Σ
= 3 ƒc — 5 χ

= R — d — 5 Σ

3 f = 5 r — 2 ƒc
= 4 R — 5 ƒ€
= Σ + m — d
= R + r — 7 Σ
= R + χ — 8 Σ
= R + ƒ€ — 9 Σ
= R + ƒc — 10 Σ
= ∂ — 2 F — 24 Σ

7 f = ∂ — 2 d — 24 Σ,

f = ½ R — 2½ Σ
= R — ƒc
= 1⅓ R — 1⅔ ƒ€
= 3 R — 5 χ
= ƒ€ — 4 Σ
= 5 ƒ€ — 4 ƒc
= ƒc — 5 Σ
= 1½ ƒc — 2½ χ
= φ — €
= 𝒮 — 3 đ

f = ε + R — ∂
= 2 c + φ — ʃ
= 3 c + r — ʃ
= ∂ + φ — 𝒮
= 𝒮 + φ — L
= F + 3 ϖ — L
= € + 3 đ — L
= € + 4 đ — P
= P + φ — S
= 2 ε + 10 S — 9 S
= 2 S + φ — T
= 7 t + 5 S — 9 T

f = ∂ — 2 € — 6 Σ
= ∂ — 2 m — 26 Σ
= 𝒮 — 3 € — 6 Σ
= 𝒮 — 3 m — 36 Σ
= 2 𝒮 — S — 4 Σ
= L — 2 ε — 4 Σ
= L — 4 m — 46 Σ
= 𝔖 — 2 € — 5 Σ
= 𝔖 — 4 m — 47 Σ
= S — 5 € — 7 Σ
= S — 5 m — 57 Σ
= P — 5 € — 8 Σ
= P — 5 m — 58 Σ
= § — 2 ʃ — 4 Σ
= § — 6 m — 68 Σ
= § — ʃ — 3 đ
= t — S — 3 đ
= t — ƒc — 8 c
= T — § — 3 đ
= T — ƒc — 10 c

½ f = r — ½ ƒ€
= ½ r — Σ
= 1½ r — χ
= 2½ r — R

⅓ f = r — ⅓ χ
= R — 1⅓ χ
= ⅓ χ — Σ
= 1⅓ χ — ƒ€
= ⅓ 𝒮 — đ

¼ f = χ — ¼ ƒ€
= ¼ ƒ€ — Σ
= 1¼ ƒ€ — ƒc

⅕ f = r — ⅕ R
= ƒ€ — ⅕ ƒc
= ⅕ ƒc — Σ
= ⅕ R — χ

(ε)

Fraction | Franca Villa

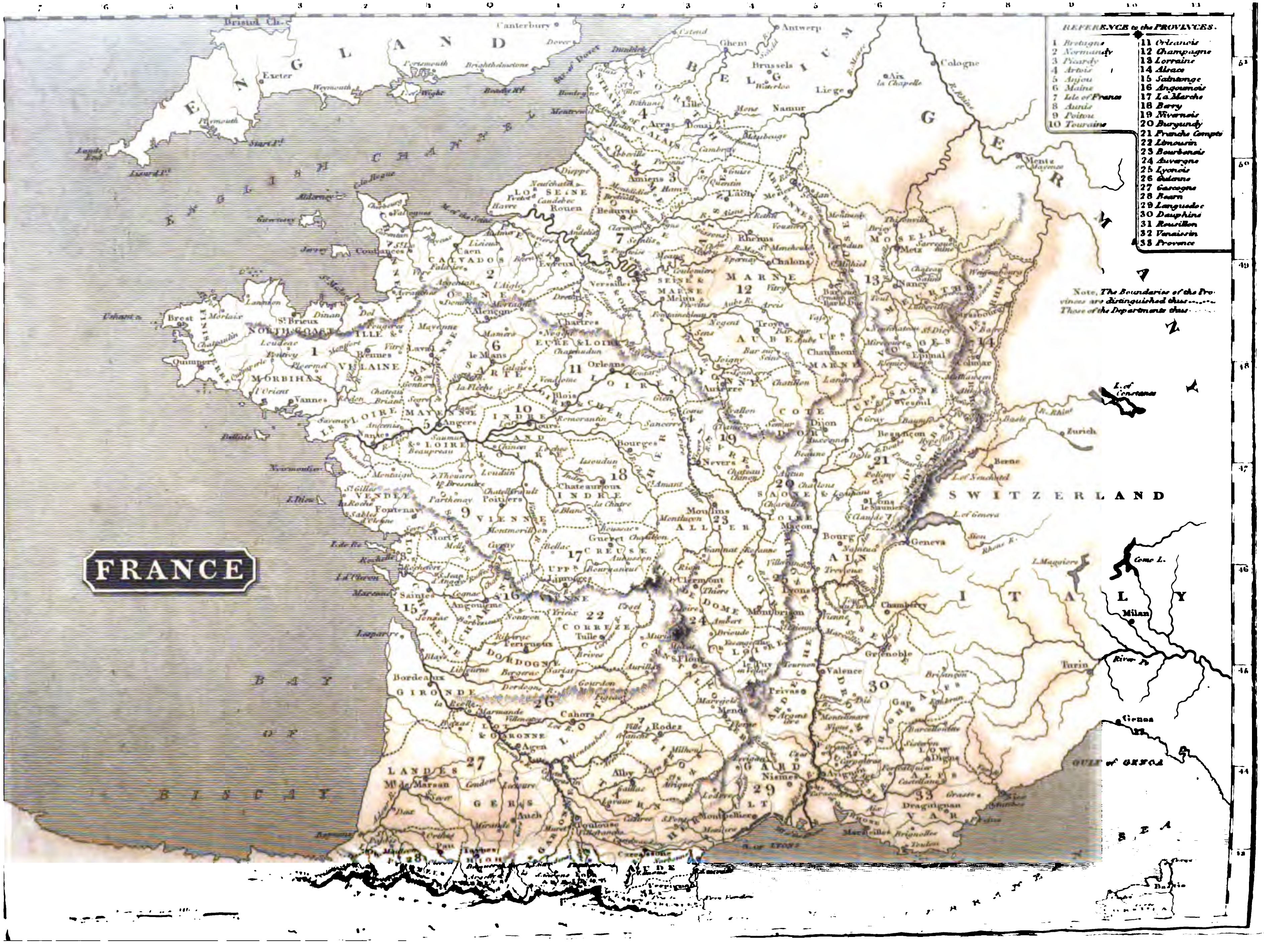
FRACTURES. See Surgery.

FRAGA, the *Galica Flavia* of Ptolemy, is a town of Spain, in the kingdom of Arragon. It is situated on the left bank of the river Cinca, which bathes its walls, and is built between two mountains, partly on the declivity of each. The streets are steep, narrow, and crooked, and are wretchedly paved with sharp pebbles. The houses resemble huts and ruins, and the meanness of their appearance forms a singular contrast with the armorial bearings with which their vain possessors have sought to adorn them. A long and narrow but tolerably handsome quay has been lately built on the bank of the river, which leads to a handsome wooden bridge of twenty-two arches, which opens at the end opposite to the town, into a large *place* adorned with stone seats, and having a tolerably thick wood behind it. About 200 yards up the road is a convent of Capuchins, having an immense inclosure, and a spacious and elegant garden. Fraga was once a fortified town, and was defended by a castle, the ruins of which are still to be seen on the top of the mountain. All travellers are here searched by the custom-house officers. Fraga is in the diocese of Lerida. It is the residence of a vicar of the bishop, who is charged with the ecclesiastical jurisdiction of the part of Arragon, in this diocese. It has two alcades, eight regidors, three gates, a convent of Grand Augustines, and two parish churches; which exhibit nothing worthy of notice. Population 3000. East Long. 0° 17′, North Lat. 41° 27′. See Laborde's *View of Spain*, vol. ii. p. 246. (w)

FRAMING of Timber. From our Treatise on Carpentry we have made a reference to the present head for an account of the principles of Framing; but having been disappointed in receiving the article, we must refer the reader to the article Roof. See also Joining.

FRANCAIS, Port de, is the name of a bay or harbour on the north-west coast of America, situated in North Lat. 58° 37′, and West Long. 142° 10′. The variation of the compass was found by La Peyrouse to be 28° E., and the dip 74°. An account of the manners of the natives, and other particulars, will be found in La Peyrouse's *Voyage*, vol. i. (w)

FRANCA Villa, is the name of a town of Italy, in the kingdom of Naples, and province of Otranto. It had its origin in a colony established in 1310, by Philip of Anjou, prince of Taranto. The town is large and well built, and the houses are splendid, and the streets straight and spacious. The mansion of the prince of Taranto is a quadrangular castle, encircled with a dry ditch. Since the year 1734, when a part of the town was destroyed by an earthquake, the houses have not been built higher than one story above the ground floor. The principal trade of the place consists in oil, cotton, and tobacco. Population 12,000. (w)


FRANCE
REFERENCE to the PROVINCES.
1 Bretagne
2 Normandy
3 Picardy
4 Artois
5 Anjou
6 Maine
7 Isle of France
8 Aunis
9 Poitou
10 Touraine
11 Orleanois
12 Champagne
13 Lorraine
14 Alsace
15 Saintonge
16 Angoumois
17 La Marche
18 Berry
19 Nivernois
20 Burgundy
21 Franche Compte
22 Limousin
23 Bourbonois
24 Auvergne
25 Lyonois
26 Guienne
27 Gascogne
28 Bearn
29 Languedoc
30 Dauphiné
31 Rousillon
32 Venaissin
33 Provence
Note, The Boundaries of the Provinces are distinguished thus
Those of the Departments thus
ENGLAND
ENGLISH CHANNEL
BAY OF BISCAY
BELGIUM
GERMANY
SWITZERLAND
ITALY
GULF of GENOA
SEA
Canterbury
Exeter
Plymouth
Portsmouth
Brighthelmstone
Weymouth
I. of Wight
Dover
Lands End
Lizard Pt.
Start Pt.
Bristol Ch.
Antwerp
Ghent
Brussels
Waterloo
Namur
Liege
Cologne
Aix la Chapelle
Mentz or Mayence
Alderney
Guernsey
Jersey
Ushant
Belleisle
Noirmoutier
I. Dieu
I. de Re
I. d'Oleron
Brest
Morlaix
St. Brieux
Dinan
Rennes
Vannes
L'Orient
Quimper
Nantes
Angers
Laval
Le Mans
Alençon
Caen
Coutances
Cherbourg
Rouen
Havre
Dieppe
Amiens
Arras
Lille
Calais
Boulogne
Beauvais
Paris
Versailles
Chartres
Orleans
Blois
Tours
Bourges
Nevers
Poitiers
Niort
La Rochelle
Rochefort
Saintes
Angoulême
Limoges
Gueret
Moulins
Clermont
Le Puy
Aurillac
Tulle
Perigueux
Bordeaux
Agen
Cahors
Montauban
Toulouse
Auch
Mt. de Marsan
Bayonne
Pau
Tarbes
Rodez
Alby
Mende
Privas
Nismes
Montpellier
Carcassonne
Perpignan
Marseilles
Toulon
Draguignan
Digne
Gap
Grenoble
Valence
Avignon
Lyons
Macon
Bourg
Dijon
Besançon
Vesoul
Chaumont
Troyes
Auxerre
Chalons
Rheims
Laon
Mezieres
Metz
Nancy
Bar le Duc
Epinal
Colmar
Strasbourg
Basle
Berne
Zurich
Geneva
L. of Geneva
L. of Neufchatel
L. of Constance
L. Maggiore
Como L.
Chamberry
Turin
Milan
Genoa
River Po
R. Rhine
CALVADOS
SEINE
MARNE
AUBE
LOIRE
INDRE
VIENNE
CREUSE
CORREZE
DORDOGNE
GIRONDE
LANDES
GERS
GARD
ALLIER
AIN
MOSELLE
VAR
JURA
NORTH COAST
MORBIHAN
VENDEE
SARTHE
ORNE

FRANCE.

History.

Sketch of ncient aul.

Ancient Gaul comprehended the whole country between the Pyrenees, the Alps, the Rhine, and the Ocean; it was therefore of greater extent than modern France, as it existed previously to the Revolution; for to the dominions of that kingdom must be added, to form an accurate and complete estimate of the size of ancient *Gaul*, the duchy of Savoy, the cantons of Switzerland, the four electorates of the Rhine, and the territories of Liege, Luxemburgh, Hainault, Flanders, and Brabant. Gaul was added to the dominions of the Roman empire, principally by the valour and talents of Julius Cæsar; but it was not divided as a portion of that empire, till the reign of Augustus. This monarch introduced a division equally adapted to the course of the rivers, the progress of the legions, and the most prominent national distinctions, which had comprehended above 100 independent states. The colony of Narbonne gave its name to the sea coast of the Mediterranean, Languedoc, Provence, and Dauphine; the government of Aquitaine extended from the Pyrenees to the Loire; the celebrated *colony* of Lugdunum or Lyons bestowed its appellation on the country between the Loire and the Seine, which, however, was originally denominated *Celtic Gaul*. Beyond the Seine the Belgic division lay: this portion of Gaul, in more ancient times, had been bounded only by *the Rhine*; but a short time before the conquest of Gaul by Julius Cæsar, the Germans being superior to the Gauls in number and valour, and like all savage nations, and too many modern ones, regarding this as a sufficient reason for attacking their less powerful neighbours, had seized on a considerable part of the Belgic territory. The Romans gave to this portion the names of Upper and Lower Germany for no other reason, but because it was inhabited by people who had passed into Gaul from Germany. From this sketch of ancient Gaul, as compared with modern France, it will be seen, that the latter comprehends the whole of the Narbonnese, Aquitaine and Celtic, or Lyonese divisions of the former, and part of the divisions which were called the Belgic and the two Germanies.

anks. 40.

The modern name of France is derived from the *Franks*. About the year 240, a confederacy was formed under the name of *Franks*, by the inhabitants of the Lower Rhine and the Weser, who, in the time of Tacitus, passed under the appellations of *Chauci, Cherusci, Catti*, &c. The first, in their inaccessible morasses, had long defied the Roman arms; the *Cherusci* were proud of the fame of Arminius; and the *Catti* were formidable, on account of their firm and intrepid infantry. In the reign of Gallienus, they threatened Gaul; but at this time their ravages took another direction, and Spain and Africa trembled at their presence. For a great number of years afterwards we lose sight of the Franks, but when the throne of Valentinian was powerfully assaulted by Attila, they gained possession of part of Gaul, a small *village* between Louvain and Brussels, having been the residence of Clodion, the first of their kings mentioned in authentic history. Even before this conquest, they had established the right of hereditary succession in the noble family of the Merovingians. The symbol of military command was a buckler, on which the princes of this race were elevated: and the royal fashion of long hair was the exclusive mark of their birth and dignity; while the rest of the nation were obliged, either by law or custom, to shave the hinder part of the head, to comb the hair over the forehead, and to content themselves with two small whiskers. The Franks were distinguished from the inhabitants of the country in which they had now fixed themselves, by their lofty stature, and blue eyes; by their close apparel; their weighty sword suspended from a broad belt; a large shield; and their expertness in running, leaping, swimming, and darting the javelin or battle-axe with unerring aim.

History.

Clovis. A. D. 481.

Of the particular circumstances attending the extension of the conquests of the Franks, little is known: their regular and connected history begins with Clovis, in the year 481. This monarch atchieved the conquest of Gaul, by the defeat of the Roman governor; and by his marriage with Clotilda, added Burgundy, of which her father was sovereign, to his dominions. Clotilda converted her husband to Christianity, and the conversion of his subjects followed. Clovis conquered Aquitaine, but retained it but a short time; he died in 511. In the last year of his reign, he reformed and published the Salic laws: a few lines of these, which debarred women from inheriting what were called the Salic lands, have been applied as precluding females from the succession to the French throne.

Mayors of the palace. A. D. 638.

The successors of Clovis were in general weak and wicked, till, on the death of Dagobert II. 638, who left two infant sons, the sovereignty was taken from them by the mayors of the palace, who were the first officers of the royal household. This office, from a personal dignity, became hereditary in the family of Pepin Heristel. His son, Charles Martel, succeeded to the power of his father, though he still retained the name of mayor of the palace. He delivered France from the ravages of the Saracens, by a dreadful battle, in which they were utterly defeated, fought between Tours and Poictiers, A.D. 732. His grandson, Pepin le Bref, removing from the throne the Merovingian race, assumed, by the authority of a papal decree, the title of king, and reigned for seventeen years with dignity and success; the founder of the second race of the French monarchs, known by the name of the Carlovingian race. In his time, the monarchy of the Franks was divided into two large districts, Austrisia and Neustria. On his death-bed, he called a council of his grandees, and, with their consent, divided his dominions between his two sons, Charles and Carloman.

Carlovingian race.

Charlemagne.

Carloman dying a few years after his father, Charles succeeded to the undivided sovereignty. This monarch, so honourably known in history by the name of Charlemagne, reigned 45 years, during which period he extended the limits of his empire beyond the Danube; subdued Dalmatia, Istria and Dacia, all the barbarous tribes to the banks of the Vistula, made himself master of a large part of Italy, and attacked the Saxons, Saracens, Bulgarians and Huns with success. The Pope first crowned him King of France and the Lombards, and afterwards Emperor of the West. He had no fixed capital, and even in his lifetime he divided his dominions among his children: he died A. D. 814, in the seventy-second year of his age.

Origin of parliaments.

In the time of Pepin le Bref, the system of annual parliaments, held first in March, and afterwards in May, had been established or restored. Charlemagne ordered these assemblies to be held twice a year, in spring and autumn. The business of the first assembly was to prepare and digest what the second was to enact into laws. Of this assembly he constituted the people a part, so that it consisted of three estates. The sovereign never was present, unless to ratify its decrees. In this reign also, the kingdom was divided into provinces and districts; the latter were under the superintendance of royal envoys, chosen from the nobles and clergy, who were bound to visit their territories every three months, and to make their reports to the sovereign at the general assembly.

Louis le Debonnaire. A. D. 816.

Of all Charlemagne's lawful sons, only Louis le Debonnaire survived him, who was consecrated Emperor and King of the Franks, at Aix la Chapelle, A. D. 816. Having very imprudently divided his territories, very soon after his succession, among his sons, they made open war against him, and he was compelled to surrender himself a prisoner to his rebellious children. His spirits were thus broken, his health decayed, and he terminated an inglorious and turbulent reign, A. D. 840.

Lotharius, his eldest son, was now emperor; but the quarrels among the brothers, which had begun even in their father's lifetime, still continued. Lotharius, in conjunction with Pepin his brother's son, took up arms against the two other sons of Louis, Charles the Bald, a son by a second marriage, to whom Aquitaine had been given, and Louis, who had received Bavaria from his father. A dreadful battle was fought at Fontenay, in which Lotharius was defeated. A council of bishops was immediately held; Lotharius was deposed, and his conquerors were permitted to reign by the clergy, on the condition of implicit obedience to spiritual authority. Lotharius, however, contrived to accommodate matters with his brothers in such a manner, that they agreed to a new division of the empire. By this division, A. D. 843, the western part of France, called Neustria and Aquitaine, was assigned to Charles the Bald. Lotharius retained the title of Emperor, with the nominal sovereignty of Italy, and the real possession of Lorraine, Franche Compte, Provence, and the Lyonnois; while the kingdom of Germany was allotted to Louis.

Division of the empire. A. D. 843.

On the death of Lotharius, Charles the Bald assumed the empire, having purchased it from the Pope, on condition of holding it from the holy see. This prince was the first of the French monarchs who made dignitaries and honours hereditary: he died by poison, after a weak and inglorious reign, A. D. 877. During his reign, the Normans, who had first made their appearance in France in 843, sailed up the Seine, and burned Paris.

Invasion of the Normans.

Charles the Bald was succeeded by his son Louis the Stammerer, who, after reigning only about two years, died in 879, leaving his queen Adelaide pregnant. He was succeeded by Louis III., and Carloman II. his two sons by a former marriage. On the death of these princes, in 884, the Emperor Charles the Fat, son of Louis the German, was elected king of France. He disgraced himself, by ceding Friesland to the Normans; but this cession was not only disgraceful, but impolitic, for it served only as a fresh incentive to depredation. Paris was attacked a second time, but gallantly defended by Count Eudes and Bishop Goslin. A truce was concluded, but the Normans, after leaving Paris, besieged Sens and plundered Burgundy. During these transactions, Charles was deposed by an assembly of the states, who conferred the crown on Eudes. His title to the throne, however, was never acknowledged by a great part of the states of France, who, on the contrary, gave their allegiance to Charles the Simple, son of Louis the Stammerer, by Adelaide. During a reign of ten years, Eudes manfully withstood the Normans.

Kingdom of Normandy established. A. D. 912.

After the death of Eudes, in 898, Charles succeeded to the throne of France; but his reign was by no means tranquil, the nobles aspiring openly at independency, and depressing the great body of the people. In the midst of these internal disorders, the Normans gained a permanent footing in France; Rollo the Norman, in 912, compelling the king to yield him a large portion of the territory of Neustria, and to give him his daughter in marriage. The new kingdom was called Normandy, of which Rouen was the capital. In the same year, the empire of Germany was separated from France, by the death of Louis IV. son of the Emperor Arnold. Charles the Simple being equally contemptible to the French and the Normans, was deposed in 922, and Robert, Duke of France, brother to Eudes, proclaimed king. Robert, however, was soon afterwards killed in battle. His son, Hugh the Great, instead of assuming the sovereignty, placed the crown on the head of Rodolph, Duke of Burgundy, who assumed the title of king, and was almost universally acknowledged. In this extremity, Charles endeavoured to gain the assistance of the Duke of Normandy, and the Emperor of Germany; but being betrayed, and thrown into prison by the court of Vermandois, he died there in 929.

After his death, Rodolph being now indisputed master of France, acted with great decision and vigour. He repelled the incursions of some new tribes of Normans, restrained the licentiousness of the nobles, and restored tranquillity to his kingdom. He died without issue, in 936. An interregnum ensued, and France was again involved in troubles. At last Hugh the Great, still unambitious of sovereignty himself, recalled Louis the son of Charles, who had taken refuge in England: from this circumstance he was surnamed the Stranger.

When Louis was called to the throne he was only 17 years old, and was little acquainted with the affairs of France, or the manners of the people. Notwithstanding these disadvantages, he conducted himself with considerable propriety, though with a portion of spirit rather creditable than useful to him; for, not liking the tyranny of Hugh, who had been appointed his tutor, he made a fruitless attempt to rescue himself from this bondage; but, after a variety of struggles, he was compelled to make peace with his vassal, and to confirm to him the county of Laon, which comprehended almost the whole of the royal domain.

Louis the Stranger died in 954, and left to his son Lothario only a shadow of royalty; for, though Hugh the Great died in 955, he was succeeded in consequence, abilities, and influence, by his son Hugh Capet, soon destined to be on the throne of France. Lothario died in 986, and was quietly succeeded by his son Louis V., who governed, under the direction of Hugh Capet, during a short reign of one year and two months. In him ended the Carlovingian race of kings, A. D. 987.

Hugh Capet being the most powerful nobleman in

Hugh Capet. A. D. 987.

France, seized the crown on the death of Louis V.; and, as he possessed the dukedom of France, which extended as far as Touraine, and was also count of Paris, and in possession of large territories in Picardy and Champaigne, while the royal domain was reduced to the cities of Laon and Soissons, he in fact brought more strength to the crown than he derived from it. Though the right of succession belonged to Charles, Duke of Lorrain, uncle to Louis V., yet Hugh Capet, by his power, and by securing the favour of the clergy, was acknowledged in an assembly of the nobles, and was afterwards anointed at Rheims. In order to establish the throne in his family during his lifetime, he associated his son Robert in the government of the kingdom, and prudently vested him with those insignia of royalty which he denied himself, lest he should displease those who had been very lately his equals. The Duke of Lorraine did not give up his right to the crown of Fance without a struggle; but, being defeated, he was made prisoner by Hugh Capet. In 996 this monarch died, and was quietly succeeded by his son Robert. This prince had married Bertha, his cousin in the fourth degree; but though this marriage had been authorised by the bishops, Pope Gregory V. undertook to dissolve it, under the pretence that it was within the forbidden degrees of consanguinity. Robert, however, persisted in keeping his wife, and was on this account excommunicated. Such was the effect of the excommunication, that he was abandoned by all his courtiers and his servants, except two, who threw to the dogs all the victuals their master left, and purified by fire the vessels in which he had been served. The king, alarmed either at his spiritual punishment, or at the commencing commotions in his kingdom, at last divorced his wife, and married Constance, daughter to the Count of Arles. The last years of his reign were rendered very unfortunate by the disorders of his family. His eldest son Hugh, whom he had associated in the sovereignty, was dead; and Constance, who was an imperious termagant, wished to place her younger son Robert on the throne; but the king, by the advice of his parliament, confirmed the succession of Henry, his eldest surviving son. In the midst of these disorders the king died, in A. D. 1031, and was succeeded by Henry I.

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Henry was 27 years old when he ascended the throne. He combined the activity and spirit of a young man with a sagacity and prudence far beyond his years; and he had need of all his qualities; for his mother Constance endeavoured to dethrone him, having drawn to her party a number of the nobles and bishops, under the pretext of supporting the rights of her son Robert. Henry resisted for some time, but at length was obliged to take refuge with Robert, Duke of Normandy, who received him most kindly, and sent an army of Normans into France, while the king and royal party invaded it on another side. The queen was thus humbled, and Henry recovered his power, but at the expence of part of his dominions, which, out of gratitude, he made over to the Duke of Normandy.

Soon after Henry was restored, the Duke of Normandy made a pilgrimage to Jerusalem; and, dying before his return, there was a dispute concerning the succession to his dominions. His natural son William had been recognised by the nobles, before the departure of Robert; and his guardianship was entrusted to the King of France and the Duke of Bretagne. As soon as the death of Robert was known, the Norman nobles broke out into personal quarrels, which the Duke of Bretagne in vain endeavoured to appease. Under these circumstances, the King of France had an excellent opportunity of displaying his gratitude for the favours which he had received from Robert; but he seemed rather willing to deprive his infant son of his inheritance, by invading Normandy. Not finding, however, the conquest so easy as he expected, he reassumed the appearance of friendship and generosity, united his forces with those of the young Duke, and the malcontents were totally routed in the battle of Val de Dunes, A. D. 1046.

Philip I. A. D. 1060.

In 1060, Henry I. was succeeded by his son Philip I.; and about six years afterwards, William, Duke of Normandy, successfully invaded England. Philip was only eight years old when his father died, and remained under the guardianship of Baldwin V., surnamed the Pious, Count of Flanders, a man of strict honour and integrity, till the year 1067, when Baldwin died, having, just before his death, concluded an offensive and defensive alliance between the crowns of Scotland and France.

Philip incurred the excommunication of Urban II. by his marrying Bertrand de Montfort, Duchess of Anjou, while her husband and his queen were both alive; nor was the excommunication taken off till the death of the Pope and the Queen in 1097. Philip, however, though relieved from his domestic troubles, was exposed to the rapacious power of his nobles, who insulted him constantly, and cut off entirely the communication between Paris and Orleans. In order to remedy these evils, Philip associated with him his son Louis. This prince was active, vigorous, generous, affable, and free from most youthful vices. He soon perceived the full extent and the exact nature of the dangers which surrounded him, and that nothing could be accomplished by force. He therefore kept continually in the field with a small body of troops about him, whom he employed against such nobles as would not listen to the dictates of justice and equity; he demolished their castles, and laid waste their ground; and by these measures, and by compelling them to render restitution to those whom they had pillaged, he restored order to the state, preserved the monarchy from subversion, and gained the affections of the virtuous part of the nobility, and the reverence of the people.

Louis the Gross, A. D. 1108.

In 1108, when he was 30 years old, he succeeded his father. From his great size in the latter part of his life, he was called Louis the Gross. Soon after his coronation, he engaged in a war with Henry I. of England, the particulars of which will be found in our history of that kingdom. After the peace between these monarchs, which took place A. D. 1128, Louis devoted himself to the regulation of the internal management of his kingdom. He re-established the commons, or third estate, which had long ceased to exercise its privileges; he enfranchised the villains, or bondsmen; diminished the authority of the seignorial jurisdictions, and sent commissaries into the provinces to receive complaints, redress wrongs, and encourage appeals to the royal judges. In the midst of these wise regulations, his excessive corpulency brought on a disorder which terminated in his death, in the 60th year of his age, and 30th of his reign, A. D. 1137.

Louis the Young, A. D. 1137.

Louis VII., surnamed the Young, to distinguish him from his father, was 18 years of age when he ascended the throne. He was of a devout turn of mind, good-natured, and easy in his temper; but jealous of his honour and of his rights. The chapter of Bourges, having chosen an archbishop disagreeable to the court, he ordered them to choose another; but the chapter was supported by Pope Innocent II., who insulted the king, by calling him a young man, whom it was necessary to instruct that he had no right to interfere in the affairs of the church. Louis, however, remained firm; and his kingdom was placed under an interdict. Thibaut, Count of Champagne, had declared himself for the archbishop confirmed by the Pope, and thus gave rise to a civil war. Louis made himself master of Champagne, and set fire to the church of Vitry, into which the inhabitants of that town had fled for refuge. The effect of this was strongly impressed on the king's mind, not only on account of the number of lives who were lost, but also on the sacrilege which he had committed; and he made a vow to visit the Holy Land, in order to expiate his crime. To this project he was further incited by Bernard, abbot of Clairvaux, who had been selected by Pope Eugenius III. to preach a crusade. In the market place of Vezelar in Burgundy, Louis was seen by the side of Bernard, seconding the exhortations of that monk for the nobles and peasantry to take the cross, both by his harangues and his example. In vain did Seiger, abbot of St Denis, a man of sound sense, and wonderfully free from the mad enthusiasm of the age, endeavour to dissuade Louis from this enterprise. He foretold the inconveniences that would result from it, and the danger to which the king would be exposed; but Bernard, on the other hand, made himself answerable for its success, and extolled it with an enthusiasm that passed for inspiration. Before his departure, however, the king had the good sense to name Seiger minister to the regent, whom he left in charge of the kingdom.

Embarks in a crusade.

Such was the rage for the crusade in France and Germany, at this period, that Louis reckoned in his army 70,000 men in complete armour, with a very great number of light horse, besides infantry; but this force, though doubled by what the Emperor of Germany brought along with him, was rendered of little or no benefit to the cause in which they were engaged, by its very numbers, and by the total want of order and discipline. The Emperor of Germany fell into a snare set for him by the Sultan of Iconium; and the same misfortune soon afterwards befel Louis. He met likewise with another calamity still more grievous, and which gave him more uneasiness than the loss of his army; for his queen Eleanor, whose affection and zeal led her to embrace the cross, and accompany him into Asia, was suspected of an amour with the prince of Antioch. His marriage with her had been entered into contrary to the advice of Seiger; and, after the death of that minister, Louis, convinced of the soundness of his opinion by the conduct of his wife, divorced her, and restored to her the provinces of Guienne and Poitou, which he had received with her in marriage. Eleanor, soon after her divorce, married Henry Plantagenet, Duke of Normandy, who, the following year, became King of England, under the name of Henry II. The remainder of Louis's reign presents nothing worthy of notice. He frequently quarrelled with Henry II. of England; but their quarrels were soon made up. In 1179, he made his son Philip, who was then 14 years old, be crowned at Rheims; and the following year he died of a paralytic stroke, at the age of 60

Philip II.
A.D. 1180.

Philip II., who was afterwards surnamed Augustus, on account of his exploits, had as his guardian the Count of Flanders. He signalized the commencement of his reign by confiscating the property of the Jews in France, and banishing them from the kingdom. He next turned his attention to the improvement of Paris, which he enlarged and paved. It was soon apparent, that Philip was by no means disposed to suffer his authority to be trampled upon or curtailed, even by the clergy; for, on an emergency, finding it necessary to raise some troops, he demanded a subsidy from the clergy of Rheims; they refused the subsidy, but offered their prayers for his success. Soon afterwards, their territories were laid waste by some of the neighbouring nobles, and they applied to the king for succour; but his reply was, that he would use his intreaties to these nobles to respect the territory of the church. He did so, but they continued their ravages; and at length the clergy found themselves under the necessity of complying with the demand of the king, in order that they might obtain his assistance against their invaders. Philip next turned his attention to the extirpation of the brigands, who, under the name of *Roturiers*, infested France, setting at nought both the civil and ecclesiastical power. In one battle he destroyed 7000 of them.

Quarrels between England and France.

The quarrels which had existed between Philip's father and the King of England still existed; Philip encouraging Henry's sons in their undutiful behaviour towards their father. But the quarrels being in some degree quieted, by the death of Henry's two most rebellious sons, the monarchs assumed the cross, and prepared for the Holy Land. This enterprise, however, was surrounded with great obstacles. Philip still jealous of heresy, entered into a private confederacy with Richard, now heir apparent to the throne of England, and Henry found himself obliged, at an advanced age, to defend his dominions against France and his own son. Being unsuccessful, he engaged to pay Philip a compensation for the charges of the war. Notwithstanding this success, however, Philip felt himself relieved by the death of Henry, which took place A. D. 1189. The project of a holy war was again entertained. Both Philip and Richard King of England partook of the superstitious prejudices and zeal of the age, and they both were also eager after military glory. Thus they expected to satisfy both their religious and their military feelings, by an expedition to the Holy Land. As, however, former attempts had been so unsuccessful, it was necessary to try another road; and they accordingly resolved to conduct their armies by sea, to carry their provisions along with them, and by means of their naval power, to preserve an open and regular communication with their own states, and with the western parts of Europe. On the plains of Fezelai, in Burgundy, the monarchs assembled their armies, which amounted to 100,000 men. After renewing their oaths of friendship, and pledging their faith not to invade each other's dominions during the crusade, they separated, Philip taking the road to Genoa, Richard that to Marseilles. From these parts, they both put to sea; and both were compelled by a storm to take shelter in Messina, where they were detained the whole of the winter A. D. 1190-1191. The siege and capture of Acre was the sole fruit of this immense expedition. Philip fell sick, and returned to France. Richard remained some time afterwards; and on his return, having been made prisoner in Germany, the French king, forgetful of his oath, endeavoured to profit by the absence of

Expedition to the Holy Land A. D.

Richard, and entered into a treaty with John, his perfidious brother. As soon as Richard recovered his freedom, he turned his thoughts towards vengeance on Philip. But the latter gained several advantages over his opponent; and these two princes continued to harass each other, till the death of Richard, A. D. 1199. John, who succeeded to the throne of England, having refused to appear as a vassal of France, to answer for the death of Arthur of Bretagne, all his territories that were situated in that kingdom were confiscated by Philip, who took possession of Normandy, and united it to his crown. Touraine, Anjou, and Maine, were also wrested from John; so that nothing remained to him in France but Guienne.

In 1213, Philip was chosen by the Pope to carry into execution the sentence of excommunication pronounced against John; and as a reward, he was to receive the remission of all his sins, endless spiritual benefits, and the kingdom of England. Philip accordingly levied a great army, and prepared for the invasion of England. Nor was John idle or unprepared. But while Europe was in expectation of a dreadful contest, the Pope persuaded John to hold his dominions as a feudatory territory of the Church of Rome. Philip was enraged at being thus duped: his fleet put to sea, but it was utterly destroyed by that of England; and John was strengthened by an alliance with the Emperor Otho IV. At Rouvenis, a small village between Lisle and Tournay, the Emperor's army, amounting to upwards of 50,000 men, was met by that of Philip, which was rather inferior. A dreadful battle was fought; the Emperor and his allies were routed, and 30,000 Germans are said to have been slain. After this victory, Philip entered Paris in triumph; the Counts of Flanders and Boulogne, his prisoners, gracing the car of the conqueror.

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In 1215, the Barons of England, dreading the total loss of their liberties, their possessions, and their lives, in consequence of the proceedings of John, offered the crown to Louis, the eldest son of Philip. Louis accepted the offer; landed in England; but disgusted the people by his partiality to his own countrymen, so that, on the death of John, and the Barons agreeing to acknowledge the authority of his son Henry III. Louis was obliged to return to France. Soon after his return in 1223, Philip died, leaving the kingdom of France twice as large as he had received it.

VIII.
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Louis VIII. reigned but about three years, the greatest part of which was chiefly spent in a crusade against the Albigenses. He was succeeded, A. D. 1226, by his son Louis IX. commonly called Saint Louis, then only 12 years of age. Blanche of Castile, the Queen-mother, had been appointed regent; and during the minority of her son, she repressed the ambition of the powerful and turbulent barons, by her prudence and firmness. As Louis advanced to manhood, his singular character developed itself. He was infected with a mean and abject superstition, yet endowed with a large portion of courage and magnanimity. His justice and integrity was conspicuous; and where superstition did not turn him aside from the bent of his natural inclination, he was mild and humane. But the barbarous devotion of the times led him often astray. He favoured the tribunal of the Inquisition, persecuted heretics, and considered a war against the Infidels as the most meritorious action he could perform. This turn of mind was strengthened by a dangerous illness with which he was attacked; for his heated imagination made him fancy that he heard a voice from heaven, commanding him to shed the blood of Infidels. Accordingly, he made a vow to take the cross, and spent four years in preparing for his expedition. He entrusted the government of the kingdom to the care of his mother; and at last, every thing being arranged A. D. 1248, he sailed for Cyprus, accompanied by his queen, his three brothers, and almost all the knights of France. From this island, he proceeded to Egypt, instead of going directly to the Holy Land; and, in 1249, he landed with his army near the city of Damietta. Soon afterwards, having received a reinforcement from France, his army amounted to 60,000 men. But this expedition was as unfortunate as those which had preceded it. Nearly half the French troops fell a prey to sickness and debauchery. The rest were defeated by the Sultan of Egypt at Massoura, where Louis, two of his brothers, and all his nobility, were taken prisoners; his third brother having been killed by his side. The Queen of France had been left in Damietta; this place was besieged, but it made a gallant defence, till a treaty was concluded with the Sultan, by which it was given up in consideration of the king's liberty; and a large sum paid for the ransom of the other prisoners. Louis, notwithstanding all chance of success had long been at an end, was still so bent on fulfilling his vow, that he set out for Palestine, where he remained four years, without being able to accomplish any thing. In the mean time, the affairs of France were in the greatest disorder, in consequence of a monk having collected upwards of 100,000 men, under the pretence of leading them to the assistance of their sovereign. This multitude robbed and pillaged wherever they came; nor were they dispersed without considerable difficulty. In 1258, the Queen-mother having died, Louis returned to France, where he repaired the evils occasioned by his absence, and atoned for the folly of his crusade, by his zeal for justice, his wise laws, and his virtuous example. He established, on a more solid basis than before, the right of appeal to the royal judges; prohibited private wars; substituted juridical proofs, instead of those by duel; and rescued France from the exactions of Rome. In his transactions with other sovereigns, he was also highly praise-worthy, and consulted the real interests of his own kingdom, while he behaved with justice and moderation towards them. He ceded Rousillon and Catalonia to the King of Arragon, in exchange for the claims of that monarch to some fiefs in Provence and Languedoc, and persuaded the King of England to renounce all claim to Normandy, Maine, and other forfeited provinces, by restoring to him Querci, Perigord, and the Limosin. Such was his moderation, that he was chosen, A. D. 1264, arbiter between the King of England and his barons; and his sentence, though rejected by Leicester and his party, was undoubtedly that of justice as well as wisdom. In one instance he was deserted by his love of justice. He permitted a crusade to be preached in France against the King of Sicily, in behalf of his brother, who had no right to that throne. Soon after this, A. D. 1270, he prepared for another holy war. His object was now the conquest of Tunis, or the violent conversion of its sovereign to Christianity. The Infidel rejected the alternative: but the French army, soon after its landing, was seized with an epidemic distemper, of which Louis himself, and one of his sons, as well as numbers of his troops, were the victims, A. D. 1271.

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His expedition to Egypt, A. D. 1249.

Battle of Massoura.

Louis returns to France, A. D. 1258.

Philip III. A. D. 1271.

Philip III. surnamed the Hardy, succeeded to the throne when he was 25 years old. Had it not been for the assistance afforded him by his uncle, Charles of Anjou, he would have found it impossible to have extricated himself and the remains of his army from the Infidels; but he having defeated them, concluded a peace for his nephew, on the favourable conditions that the King of Tunis should pay him a large sum of money; Charles himself the ancient tribute due to him as King of Sicily; that the Christians in Tunis should enjoy the full exercise of their religion; and that the prisoners on each side should be exchanged. Little of moment occurred after Philip's return to France. In 1274, he declared war against Alphonso of Castile, on the subject of the succession to that crown; but the war soon terminated without producing any event of consequence. Philip's character led him frequently to engage in enterprises with great alacrity and zeal; but he had not sufficient firmness to persevere in them. He was much under the influence of the Pope; and to him the papal government was indebted for the Venaissin, which they retained till the Revolution.

Sicilian Vespers, A. D. 1282.

Philip naturally took great interest in the affairs of his uncle, Charles Duke of Anjou, King of Sicily. And this leads us to notice the Sicilian Vespers. The inhabitants of Sicily, when Charles governed with more strictness than policy, resolved to rid themselves entirely of the French. They were farther excited to revolt by Peter III. King of Arragon, who laid claim to the throne of Sicily, and promised the Sicilians his assistance to expel the French. On the evening of Easter day, A. D. 1282, the massacre began. Not a Frenchman was spared. Peter arrived; was crowned at Palermo, and Charles was compelled to abandon the island. The Pope, however, embraced the side of the latter; excommunicated Peter, and gave his kingdom to Charles the second son of Philip. The King of France immediately prepared to establish his son on his new throne by force of arms; but he was not successful, and in 1285, as he was returning from this expedition, he died at Perpignan. Letters of nobility were first used in France during this reign. They were granted to Raoul, a goldsmith. This, however, was only a restoration of the old custom of the Franks, who were all esteemed equally noble. A distinct and privileged nobility first arose at the close of the second race of kings.

Philip IV. A. D. 1285.

Philip was succeeded by his son Philip IV. surnamed the Fair. The first object of this monarch was to compose all differences with his neighbours. To this step he was led by the derangement of his finances. Although in thus settling his differences, he was much indebted to Edward I. of England, yet he ungratefully, as well as impolitically, soon afterwards engaged in hostilities with him; and he also rashly attempted to gain possession of Flanders, which had joined England. But in this enterprise he was unsuccessful; though it cost him much blood and treasure. These events, however, were of trifling moment, compared to the quarrel between him and the Pope Boniface VIII. a man of a turbulent disposition, arrogant, and overbearing. He had prohibited the clergy from granting any aids. But Philip, being equally determined to support his own power, and being moreover very poor, resolved that the clergy in France should contribute, equally with his other subjects, to the exigencies of the state; and he resolved not only on this, but also forbade them to send money abroad without his permission. This gave rise to the quarrel between Boniface and the king. The former was by no means disposed to yield; on the contrary, he appointed as his legate to the court of France, Bernard Saissette, who had rebelled against the king, and who on this, as well as on account of his disposition, Boniface must have known would be particularly obnoxious to him. This legate fully acted up to the orders of his master; he braved Philip at his own court, and threatened him with an interdict. Philip was so much under the influence of superstition, or so afraid of the impression it might make on his subjects, that he did not bring the legate to trial, but contented himself with delivering him into the hand of his metropolitan. On this the Pope, enraged, issued a bull, declaring "that the Vicar of Christ is vested with full authority over the kings and kingdoms of the earth; and at the same time, the French clergy were ordered to repair to Rome. Philip commanded the bull to be committed to the flames, and the bishops not to leave France; and he seized the possessions of those who did leave it. In this state of things, he had recourse to a most politic measure. He assembled the states of the kingdom, and they disavowed the claim of the Pope, and recognised him as an independent sovereign in his own kingdom. Having proceeded thus far, Philip resolved to wage open war against Boniface; but the Pope was not intimidated. He displayed great coolness and courage. Having been insulted, however, in his own territories, by a band of desperadoes hired at the instigation of Philip, he was so much affected that he died in a few days. Benedict XI. his successor, a mild and good man, took the interdict off Philip; but this Pope was too good and wise for the age in which he lived. He was taken off by poison A. D. 1305; and his successor Clement V. being a Frenchman, and entirely in the interest of France, fixed his residence in that kingdom. Philip being now at peace, turned his attention to the internal affairs of his kingdom. Supreme tribunals, called Parliaments, were instituted, and the commons, or third estate, were formally admitted into the assemblies of the nation. So far his measures were wise and popular; but, in what regarded the finances, they were of an opposite character. The royal treasury was exhausted; and, to remedy this evil, the nominal value of money was raised. The dilapidation of his finances led the king also to adopt another measure still more unjust. The Knights Templars, a religious and military order, had acquired large possessions in almost every part of Europe, but especially in France. In consequence of the severity of the taxes which Philip levied, a sedition arose in Paris; the Knights Templars were accused of having fomented it; orders were issued that they should all be committed to prison in one day; absurd and enormous crimes were imputed to them. They were put to the rack; confession extorted, or forged confessions imputed to such as were firm; and at last Philip succeeded in destroying most of them, and in obtaining possession of their riches. Soon after this disgraceful proceeding, A. D. 1314, Philip again unsuccessfully attempted to unite Flanders to the crown of France; and his death is supposed to have been in a great measure occasioned by his failure.

Quarrels with the Pope.

His poli cal and fi nancial measures.

Knights Templa persecu

Lou A. D.

He was succeeded by his son Louis X., surnamed Huten, who was scarcely seated on his throne when he ordered his prime minister Marigny to be executed, under the pretence of his being guilty of magic, but, in reality, that he might gain possession of his wealth.

Louis, however, being improvident, soon spent the money he had thus unjustly acquired; and he was obliged, to satisfy his wants, to extort money from the nobility; to levy a tenth from the clergy, to sell their liberty to the slaves who belonged to the royal domains; and even to compel such of them to be free as wished to continue slaves. Thus the king's avarice, or prodigality benefited his subjects. It is remarkable that the edict of enfranchisement, dated 3d July 1315, declares that every person is born free by nature. The following year this monarch died, in consequence it is said of having taken ice when he was warm: it is suspected, however, that he was poisoned.

hilip V.
.D. 1316.

He was succeeded by his brother Philip V. surnamed the Long, on account of his remarkable stature. It was on occasion of this succession that the Salic law was recognised and enforced by the states of the kingdom; for Louis having left one daughter by his wife Margaret of Burgundy, the Duke of Burgundy wished to support the claims of his niece: the states, however, having been assembled, excluded her, and declared all females for ever incapable of succeeding to the throne of France. This reign presents no foreign affairs of any moment; but it may be noticed, that during it the Jews were banished, being suspected, or rather accused (for it is probable that they were not even suspected, much less proved guilty) of having poisoned the wells and fountains at the instigation of the kings of Tunis and Grenada. Philip excluded the bishops from the parliament, where they had possessed too great authority. He also obliged the burghers to deposit their arms in the arsenals, whence they were not permitted to take them, except in case of war. He likewise appointed their officers, and established a numerous militia. In another enterprise he was not successful; for he in vain attempted to establish, over all his kingdom, the same denominations of money, weights, and measures. In the midst of these projects, he died A. D. 1322.

les IV.
. 1322.

He was succeeded by his brother Charles IV. surnamed the Fair. This prince, immediately on his accession, turned his attention to the finances, in the management of which there were many abuses. At this period, the Italians in every part of Europe had the almost entire management of money concerns; and Charles having discovered that they were guilty of extortion, as well as dishonest, confiscated their property, and put some of them to death. During this reign, a short war took place between France and England, respecting a castle which Edward II. pretended belonged to him: but, in 1326, Edward III. having succeeded to the throne of England, peace was concluded between the two monarchs. Charles the Fair died in 1328, leaving the kingdom loaded with debts. He was the last of three brothers, successors of Philip the Fair, all of whom died in a short space of time.

Charles left only one child, a daughter, who of course could not succeed him; but as his queen was pregnant at the time of his death, Philip de Valois, the next male heir, was appointed regent; and, on a daughter being born, was unanimously placed on the throne of France. Though his title was indisputable, yet Edward III. of England put in his claim; and this gave rise to the most memorable events in the history both of England and France, for upwards of a century. As these, however, have been noticed in the History of ENGLAND, they shall be but very briefly narrated here. As the contest for the throne of France was one of very great importance, and likely to be long and arduous, both the competitors endeavoured to strengthen themselves by alliances. In 1346, Edward invaded France with an army of 30,000 men, and Philip advanced to meet him at the head of 100,000. On the 26th of August, in that year, the famous battle of Cressy was fought, in which the French were defeated with great slaughter. In 1347, Edward took Calais; and in the following year, he returned in triumph to England, having concluded a truce with France. In the midst of his misfortunes, Philip had the satisfaction of seeing Dauphiny annexed to the crown of France, the last Count of that province dying without issue; having ceded his territories to the crown of France, on the condition that the eldest son of the French monarch should assume the name of Dauphin. Philip died in 1350, at the age of 57, worn out with distress and anxiety. During his reign, a change took place in the constitution of the parliament, by the incorporation of the counsellors named *jureurs*, who had formerly been taken exclusively from the noblesse, and the counsellors named *rapporteurs*, who had been taken from the class of citizens. It was also in this reign that the famous tax on salt, the *gabelle*, was imposed, or rather established and augmented.

se-
Eng-
nd

John,
A. D. 1350.

John, the eldest son of Philip, succeeded to the throne; but an act of injustice towards the Constable Raoul, whom he ordered to be beheaded without any form of trial, rendered him soon very unpopular. Of this, and of other circumstances, Edward III. took advantage; for Charles, King of Navarre, setting up a claim to the throne of France, Edward resolved to support him. In this emergency, John convoked the states-general in 1355, who agreed to a levy of 30,000 lancers, besides 100,000 other troops, and to a subsidy to support them. At this assembly, a decree was passed, that no proposition should be admitted without the unanimous consent of the three branches or their deputies. Thus, the third estate, which hitherto had been too much and too often the slaves of the nobility or clergy, obtained their due share of authority. In 1355, Edward invaded France again, and sent into Guienne the Prince of Wales, who had gained so much fame at the battle of Cressy. On the 19th of September in the following year, this prince was again successful, at the battle of Poictiers, in which the French were completely defeated, and their king taken prisoner. John was treated with great attention and generosity by his captor, who, having concluded a truce for two years, brought him over to England. In consequence of the captivity of their monarch, the people of France were plunged into the greatest disorder and confusion. The Dauphin, indeed, assumed the management of affairs, but his authority and influence were not sufficient to restore tranquillity; and, as he was totally destitute of supplies, he found himself under the necessity of convoking the national assembly; but that body, instead of supporting his administration, seized the opportunity to demand limitations of the regal power. Paris itself was entirely under the dominion of the provost of the merchants: the dauphin was detained in a kind of captivity. In the midst of these disorders, the King of Navarre, who had been thrown into prison by John in the year 1355, contrived to escape, and put himself at the head of the malcontents; but his conduct was so atrocious, that even those who had previously favoured his claims, now forsook him, and resolved to strengthen the power of the dauphin. For this purpose they rallied round him, and the provost of the merchants having been slain in an attempt to deliver Paris up to the

King of Navarre, that capital returned to its allegiance, and France began again to assume the form, and enjoy the advantages of a regular government. During these disturbances, Edward was restrained by his truce from taking advantage of them; but no sooner was it expired, A. D. 1359, than he invaded France with the whole military force of England. In 1360, he concluded an advantageous treaty of peace with his prisoner King John, who thus obtained his liberty. On his return to France, however, finding that his nobility were by no means disposed to allow him to fulfil his engagements, he voluntarily came back to England, where he died at his lodgings in the Savoy, 1364.

Charles V. A. D. 1364.

John was succeeded by his son Charles V. surnamed the Wise, an epithet which he well deserved, by the prudence and policy of his conduct: his first care was to repair the losses which his kingdom had sustained from the errors of his predecessors: and having been made too sensible that the recent calamities of France had, in a great measure, sprung from the captivity and absence of the monarch, he formed a resolution never to appear personally at the head of his armies. Charles was resolved to render France, if possible, a match for England; but, in order to do this, it was necessary not only to restore tranquillity, and to introduce order and economy into all his internal arrangements; but also to bring under subjection, or weaken the King of Navarre, who, from the vicinity of his dominions, had it in his power always to prove a restless and formidable opponent. Against him, therefore, he first turned his arms; and he soon, principally by the valour of Bertrand de Guescelin, one of the most accomplished captains of the age, obliged him to sue for peace, A. D. 1365. He next settled the affairs of Bretagne. Thus having succeeded in these enterprizes, he turned his attention to the immense number of military adventurers, who, having followed Edward into France, had, under the name of Companies, become a terror to the peaceable inhabitants: these Charles soon found were too numerous and formidable to be reduced by force; he therefore had recourse to policy. Alphonso XI. King of Castile, was succeeded by his brother Peter I. surnamed the Cruel: against him, Henry, Count of Trastamara, took up arms; but being obliged to flee into France, he obtained permission from Charles to inlist the companies in his service. They readily embarked in an enterprise which promised them employment and booty; and thus Charles freed his kingdom of these adventurers.

His wise plans.

As soon as Charles was satisfied of the internal peace of France, he directed his thoughts to the reformation of the coin: he likewise lessened the taxes, encouraged agriculture and commerce, and embellished his capital. In the midst of peace, however, he was still preparing for war, and anxious to wipe off the disgrace which the successes of England had inflicted on the arms of France. An opportunity soon presented itself: the inhabitants of Guienne, oppressed by the taxes of the Prince of Wales, to whom that province had been given by his father, laid their complaints before the King of France. The Prince of Wales was cited to appear to answer these complaints: he answered that he would certainly come to Paris, but it should be at the head of 60,000 troops: but he was no longer that Black Prince, who performed even more than he threatened; he was worn out both in body and mind by sickness. In 1369, war was declared. The French were successful. Charles, relying on his superiority, pronounced a sentence of condemnation against the Prince of Wales for his contumacy in not appearing when cited; declared him and his father rebels; and confiscated all their territory in France. In a few years, the English were stript of all their ancient possessions in that kingdom, except Bourdeaux and Bayonne, and of all their conquests except Calais.

English lose most of their possessions in France.

Charles died in 1380, after a reign of great glory and benefit to his subjects.

Charles's character.

With respect to his domestic life, there are some curious particulars recorded: he always rose at six o'clock; and having performed his private devotions, as well as attended mass, he gave audience to all who presented themselves, rich and poor, receiving their petitions, and reading them himself: at 10 o'clock he dined, spending but a very short time at table, and eating only of one sort of dish: he always diluted his wine with a considerable portion of water. During dinner, he was instructed by the discourse of some wise and virtuous man. After dinner, he gave audience to the foreign ambassadors; he next admitted his ministers, and learned from them the state of the kingdom. At one o'clock, he retired into his chamber and reposed himself: an hour afterwards, his chamberlains entered and entertained him with light conversation; at three he attended vespers, and afterwards walked in his garden. On his return, the queen brought in his children, whom he interrogated respecting their progress in education. In winter, instead of walking, he employed himself in reading the Holy Scriptures. He took little supper, and went to bed early. Though he spent his time at home in this plain and simple manner, he always appeared abroad with a considerable degree of dignity and splendour: before his subjects he was always a king. His dress was magnificent; his gens-d'armes preceded him; his squires carried his ermine mantle, his sword, and his regal hat: he walked always by himself, his brothers and the princes of the blood following him at some distance. He seems to have been fond of literature, and no present was more acceptable to him than books. King John had left only 20 volumes in the royal library; he increased them to 900. In the year 1370, Charles, in order to rouse his subjects to feats of arms, forbade all games of hazard, and substituted in their place exercises with the common and the cross-bow. By another ordinance in the following year, he granted letters of nobility to all the citizens of Paris. This privilege they enjoyed till 1577, when it was restricted to the provost of the merchants, and a few others. It was entirely suppressed in 1667, and re-established in 1707; and again suppressed in 1715.

Charles V
A. D. 1

Charles the Wise was succeeded by his eldest son Charles VI. a minor: a few years before his death, Charles thinking it probable that he should leave his son very young, passed the ordinance, which fixed the majority of the French King at the age of 14. Charles VI. when he mounted the throne, was 13. His uncles, the Dukes of Anjou, Berne, and Burgundy, differed respecting the regency; but it was settled by those to whom they referred their difference, that the king should be crowned in a few months, and that in the interval he should govern in his own name, but with the advice of his uncles. Till the coronation, the Duke of Anjou seems to have had the principal management of affairs, but he employed his authority rather for his own advantage than for the benefit of the king and the people. Charles did not assume the sovereignty till the death of the Duke of Anjou in 1388: at first, it was hoped that he would prove a man of spirit and enterprize; but he soon fell into a fit of frenzy; and though he recovered, he was unequal to the government of the kingdom, on

His [illegible]

account of his frequent relapse, and his general imbecility. His first relapse was occasioned by a singular incident: At a masquerade, he, with some of his nobles, covered their bodies with rosin, powdered over, while hot, with fur. The combustible habit of one of them was accidentally set on fire: the flames communicated to some of the others, and the king was so much affected by the fright, and his narrow escape, that his disorder returned, and it afterwards generally attacked him four or five times a year to the end of his life. It is scarcely possible to conceive a court more profligate and debauched than that of France was at this period. While things were in such a situation, the Duke of Burgundy died. He was succeeded by his son, who hoped to govern France as his father had done, during the illness of Charles; but he was opposed by the Duke of Orleans, the king's brother, who relied for his authority, not so much on his relationship, as on the influence which the duchess had over Charles's mind, even in its most violent and disordered state. The quarrels between the two Dukes were carried to a great height; but at last, A. D. 1407, by the interposition of common friends, they were persuaded to enter into a league of amity, in the most solemn manner. But the Duke of Burgundy was meditating treachery. even while he was professing friendship; for he hired ruffians, who assassinated his rival in the streets of Paris, and when the ruffians gave him as their instigator, he avowed and justified the action. What is still more strange, the parliament of Paris passed over the crime, and even seemed to admit the Duke of Burgundy's justification. The consequences were such as might have been anticipated: The princes of the blood, combining with the young Duke of Orleans and his brothers, made war against the Duke of Burgundy, and the unhappy king was a prisoner, sometimes with one party and sometimes with another. The provinces were laid waste; assassinations were frequent; and law, order, justice, and humanity, were equally set at nought. Each party endeavoured to strengthen their adherents, by every mode in their power, and the fraternity of butchers in Paris having declared for the Duke of Burgundy, the adherents of the Duke of Orleans made interest with the carpenters;—the fate of the capital depending on the prevalence of either party.

Quarrels etween the Dukes of Burgundy nd Or-eans.

ril war.

Eng- invade ce.

During this calamitous state of France, England refrained from invading her, till Henry V. ascended the throne; but soon after his accession, he landed in Normandy at the head of 50,000 men: the battle of Agincourt followed, in which the French were defeated with great slaughter. Notwithstanding his success, Henry was obliged to return to England for a supply of men and money. In the mean time France was exposed to all the furies of civil war. The Duke of Burgundy, who had been worsted by his antagonists, attempted to regain possession of his power and of the person of the king; and these objects he was enabled to accomplish, in consequence of some quarrels in the royal family; the person of the king was seized by him; the dauphin made his escape with difficulty; and great numbers of the opposite faction were butchered. By this time Henry was again in a state to revisit France with a large force: he landed in Normandy and carried every thing before him; afterwards he concluded the treaty of Troyes, with the Queen and the Duke of Burgundy, by which the succession to the throne of France was secured to the King of England, and he received the princess Catherine in marriage, A. D. 1420. As soon as the dauphin heard of this treaty, he assumed the style and authority of regent, and appealed to God and his sword for the maintenance of his title; but being unequal to his adversary, he was obliged to avoid a battle. In less than two months after the death of Henry V. A. D. 1422, Charles VI. terminated his unhappy life; and the dauphin was crowned at Poictiers, (Rheims being in the possession of the English) under the name of Charles VII.

Charles VII. A. D. 1422.

This sovereign was very popular in France; and the situation of that kingdom required the exercise of all his talents, and the influence of all his popularity. On the other hand, the Duke of Bedford, the regent during the minority of Henry VI. was a man of great talents and prudence, and fully sensible of the difficulty of preserving a newly acquired kingdom against the legitimate sovereign, so well beloved as Charles was. At first, the Duke of Bedford was successful. He defeated the French, and their allies the Scots, in 1424, in the battle of Verneuil; but his next enterprize was destined to produce the ruin of the English, and their expulsion from France, by means so extraordinary, as in that age universally to be deemed miraculous. In 1428, the Duke of Bedford undertook the siege of Orleans. The affairs of Charles seemed desperate. He entertained thoughts of retiring into the remote provinces of his kingdom, where the influence of his Queen, Mary of Anjou, and of his mistress, Agnes Soreille, who lived in perfect amity with the Queen, changed his mind; and he declared his resolution to perish with honour in the midst of his friends, rather than yield ingloriously to his enemies. In the meantime Orleans still held out; and the Maid of Orleans appeared, who, by inspiriting her countrymen, and appalling the English, obliged the latter to raise the siege. This extraordinary woman had promised not only to raise the siege of this city, but also to crown Charles at Rheims, which was still in possession of the English. As soon as she had achieved the first part of her prediction, she insisted that the King should march against Rheims. She was obeyed. Charles set out for that city at the head of 12,000 men, and scarcely perceived as he passed along, that he was marching through an enemy's country. Every place opened its gates to him, and Rheims sent him its keys. He was accordingly crowned there King of France with the usual ceremonies. Soon after this, the Maid of Orleans was taken prisoner, and condemned to be burnt for sorcery and magic; but she had already completely recovered the King's affairs; and the Duke of Bedford dying soon after, Henry VI. who was a very weak prince, was obliged to withdraw his forces entirely from France, the English being expelled from all their possessions on the continent except Calais.

Maid of Orleans.

Charles's wise plans.

Charles now had time to direct his industry and judgment, to remove the numerous and oppressive evils to which France had been so long exposed. He restored the regular course of public justice; introduced order into the finances; established discipline among his troops; repressed faction in his court; revived the languid state of agriculture and the arts; and in the course of a few years, rendered the kingdom flourishing within itself, and formidable to its neighbours. In the midst of his prosperity and wise administration, Charles was extremely troubled by the conduct of the Dauphin. This young prince was possessed of spirit and courage; but his good qualities were tarnished by the roughness of his manners, and the savageness of his disposition. Discontented at court, he retired into his province of

Dauphiny; but understanding that his father wished to bring him back to Paris, he took refuge with Philip the Good, Duke of Burgundy, who willingly gave him an asylum, but would by no means encourage him in the seditious projects which he entertained against his father. When the latter heard of the place where his son had taken refuge, he observed, "The Duke of Burgundy is nourishing a fox, that will eat out his entrails." But in fact, the Dauphin was the cause of the death of the king; for the latter being apprehensive that he would poison him, refused for several days to taste any food, and being thus overcome with hunger and chagrin, he died in 1461.

Louis XI. A. D. 1461.

The Dauphin, under the name of Louis XI. succeeded his father. His first and leading object was to aggrandize the monarchy, by depressing the power of the nobles; but the latter took the alarm, and armed to defend their privileges. The King also armed. The battle of Monteleri was fought 1465, which decided nothing; but a peace was concluded on terms advantageous to the nobles. These terms, however, Louis never meant to fulfil; for having gained over many of his opponents, he used his influence with the Assembly of the States, to declare those articles of the treaty void which were most disadvantageous to him. Scarcely, however, had he succeeded in reducing his nobles to subjection by these dishonourable means, when he was again involved in trouble by his own rapacity, and became the dupe of his own artifice. For on the death of Philip the Good, Duke of Burgundy, Charles the Bold, who succeeded him, made preparations against Louis. To these he was prompted, from a thorough knowledge of his character, and a strong suspicion that Louis would soon attack him. Louis also armed; but as he was always averse to war, he agreed to pay the Duke a large sum of money, and he appointed a personal interview at a place in Picardy, then in the possession of the Duke. Louis went to the place with only a few attendants, in the hope that Charles would come with as few; but at the same time, his emissaries persuaded the inhabitants of Liege to revolt against the Duke. The latter was at first pleased with the apparent confidence of Louis in coming with so few attendants; but intelligence arriving, during the conference, that a rebellion had broken out in Liege, and that it had been instigated by the emissaries of Louis, Charles ordered the King into confinement. In this state Louis remained three days, when he was released by the Duke, on condition, that he should march along with him, and assist him in bringing the inhabitants of Liege back to their duty. Liege was reduced, and Louis was permitted to depart for his own dominions. During the remainder of his reign, this monarch continued to act with his habitual duplicity. He first excited his people to rebel, and then having crushed them, divided with his ministers, who were equally infamous with himself, their possessions. At last even his ministers conspired against him; but being defeated in their schemes, they suffered those punishments which they had so often inflicted on others. His brother Charles was poisoned; the Constable St Paul, his brother-in-law the Count of Armagnac, and the Dukes of Alençon and Nemours, were beheaded; and the children of the last named nobleman were sprinkled with the warm blood of their father, and sent in that condition to the Bastile. With England he formed an ignominious truce for seven years, engaging to pay annually 50,000 crowns of gold; and subsequently, he concluded a treaty at London with Edward IV. by which he stipulated, that the truce should be kept for 100 years after the death of each of the parties, under the original conditions. On the death of the Duke of Burgundy in 1477, Louis proposed a marriage between his son Charles, then only seven years old, and the heiress to the large possessions of that duchy, comprehending not only Burgundy, but Franche Compte, Artois, Flanders, and nearly all the rest of the Netherlands; but he was overreached by his rapacity, for having, even after he proposed marriage, seized on Burgundy as a male fief, the Princess Mary of Burgundy was alarmed, and, by the advice of her Flemish subjects, she married the Archduke Maximilian, son of the Emperor Frederic III. Hence arose those wars, which so long desolated the Low Countries, and created an implacable hatred between the houses of France and Austria.

Notwithstanding this marriage, Louis retained those places in Burgundy of which he had taken possession; and, by the further acquisition of Anjou, Maine, Provence, Bar, Rousillon, and Boulogne, he greatly augmented the kingdom of France. Soon after he had succeeded in these objects, he was suddenly seized with a fit of apoplexy, and, after enduring dreadful torments both of body and mind, died A. D. 1483. The character of Louis XI. is not easily understood: he was undoubtedly a man of considerable talents, which would have been more useful to him, had he not, in so many instances, trusted rather to his artifice than to them. He was absolute, yet not dignified; popular with the great mass of his subjects, by humbling the great; but not generous. The system on which he acted was unjust; yet, where his own views were not to be served, he was zealous for the administration of justice. Such a character, so composed of contradictions, must always be extraordinary; but, considering the age in which he lived, it is not surprising that he violated every moral principle, and yet resigned himself to the most ridiculous superstition. Yet to this king, the Pope gave the title of Most Christian.

Among the useful establishments of Louis, France is indebted to him for that of posts: he also paid great attention to commerce and manufactures; and, to encourage the latter, he invited silk manufacturers from Greece and Italy, whom he exempted from all taxes, as well as their wives and children. He issued an ordinance, permitting the clergy, nobility, and all other persons, to carry on commerce, without derogating from their rank or civil privileges. He proposed to make a collection of all the written and unwritten laws, in order to compose a regular code, and to abridge the forms of process. He also attempted to introduce uniformity of weights and measures throughout the kingdom; but, on the other hand, he increased the taxes, saying that he levied contributions on the purses of his nobles, in order to spare their blood. On his death-bed, however, he advised his son to lighten the taxes. In short, his predominant character was duplicity and dissimulation; and he frequently said, "If my hat knew my secret, I would burn it." His education of his son, from whatever motives adopted, was by no means qualified to render him fit for a throne; for he was brought up in retirement, seen by nobody but the king's servants, and permitted to engage only in the most childish amusements. He was not even instructed in letters; the king saying, that the only maxim in the Latin language worth knowing, was this: *qui nescit dissimulare, nescit regnare.*

Had not Charles VIII. his son, been naturally of good talents, as well as a good disposition, he must have been ruined by such a mode of education. He was only 13 years old when his father died; and the Duke of Orleans, as first prince of the blood, claimed the regency; but he found a competitor in the Duke of Bourbon, who maintained, that as the Duke of Orleans was only 24 years old, he himself stood in need of a guardian. The states-general were assembled at Tours, and declared that there was no necessity for a regency; they at the same time confirmed the last will of Louis, by which the care of the person of the king was entrusted to his sister Anne of France, lady of Beaujieu. This princess being a woman of talents and prudence, and, what was of more consequence, determined to discharge the duties of her situation, made choice of a council for the government of the kingdom, and gave the constable's sword to the Duke of Bourbon, brother of her husband. The speech of the deputy of the noblesse of Burgundy, at the meeting of the states, in 1484, deserves notice. "If," said he, "any dispute should arise, either with respect to the succession to the throne, or with respect to the regency, who ought to decide it but the people, from whom all sovereigns derive their authority, and in whom actually resides the sovereign power. When I say the people, I mean all the citizens, comprehending the princes of the blood themselves, as the chiefs of the order of the nobility." The commons, or third estate, made a very strong and touching representation respecting the poverty of the kingdom, and they complained of the multiplication of judicial offices, many of which were publicly sold: they demanded that the tribunals should select three men of merit, of whom the king should chuse one, to fill any vacant office; that all arbitrary and unequal taxes and impositions should be abolished; and that henceforward, in conformity to the natural freedom of France, no taxes should be imposed without the free consent of the states-general. These representations had not their full effect; nevertheless, the taxes were considerably diminished.

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The Duke of Orleans, disappointed in his expectations of the regency, went into Brittany, where he persuaded the Duke of that province to commence an insurrection; but the war was of short duration. The king was everywhere successful; and the victory which his troops gained at Saint Aubin, completed the destruction of the rebels. The Duke of Orleans was made prisoner, and shut up in the Tower of Bourges. It is supposed that his captivity was prolonged, and rendered more irksome than it otherwise would have been, in consequence of the resentment of Anne of France, whose passion he had slighted. As soon, however, as Charles took the sovereignty into his own power, he set him at liberty; and the Duke's gratitude and good sense induced him to become a loyal subject: he even used his influence with Anne of Bretagne, though he was enamoured of her, to induce her to marry the king. This happy union took place in 1491, and put an end to all the civil wars which that duchy had occasioned.

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But Charles was not destitute of ambition: Louis XI. as heir of the house of Anjou, had acquired a claim on the kingdom of Naples; he was, however, too prudent, as well as too little inclined to war, to enforce his claim. Charles, on the contrary, as soon as his kingdom was secured in tranquillity, resolved to attempt the conquest of Naples; and he accordingly set out on this hazardous expedition in 1494, almost without money, and with very few troops. At first, every thing promised success; the Italians were not warlike; Florence opened its gates; Charles made his entry into Rome as a conqueror; and the Pope was compelled to grant him the investiture of the kingdom of Naples. He lost no time, but immediately left Rome for his new kingdom. Ferdinand, his competitor, fled at his approach; the city of Naples instantly declared for him; and of the whole kingdom, only three towns continued in the interest of Ferdinand. Had Charles not been dazzled by the rapidity and splendour of his success, he would instantly have secured his conquests; but he wasted his time at Naples in festivals and triumphs, and was indulging in the vain and presumptuous hope of being able even to extend his victorious arms to Constantinople, and to subvert the Ottoman empire; while a combination was forming against him of almost all the Italian states, supported by the Emperor Maximilian, and Ferdinand King of Arragon. Charles, therefore, was soon too fatally convinced, that, instead of extending his conquests, or even retaining the kingdom he had acquired, it would be absolutely necessary for him to secure his retreat into France. On every side, his enemies collected in great force; while, to add to the difficulties and embarrassments of his situation, the Duke of Orleans neglected the cause of his sovereign and his country, to engage in an attempt against Ludovico Sforza. Charles's vigour of mind was of great avail in this emergency: At the head of not more than 9000 men, he traversed the Alps, while the confederates, though they had 30,000, were afraid to encounter him in the mountains, and patiently waited for him in an open plain near Placentia. Here the battle of Fornova was fought. Charles was among the first who charged the enemy; and his officers and soldiers, animated by the example of their sovereign, fought nobly and successfully. The Italians fled; but Charles, on account of the very great inferiority of his forces, either was not able or did not deem it prudent to pursue them, but continued his march unmolested, and soon afterwards relieved the Duke of Orleans, who was blocked up in the city of Novara by Sforza. Notwithstanding his success, the King of France would probably have found it very difficult to have extricated himself, had not a reinforcement of 16,000 Swiss troops joined him, by means of which he was placed in a situation to dictate the terms of peace with Sforza. In the mean time, Ferdinand returned to Naples, which, however, he did not reconquer, till after an obstinate defence by the Duke of Montpensier, to whom the government of it had been entrusted by Charles.

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In 1496, the King of France again prepared to invade Italy, not for the purpose of renewing his attempt on Naples, but in order to support the pretensions of the house of Orleans to the duchy of Milan. But the Duke of Orleans, who was heir to the crown of France, refused to take upon him the command of the army destined for this purpose. This refusal probably originated not so much from his apprehension of the danger and difficulty of the enterprise, as from his belief that Charles, worn out by debauchery, could not possibly long survive. In consequence of his refusal, and of some other circumstances, particularly his apparent satisfaction at the death of the dauphin, which opened up to him the immediate and almost certain prospect of the throne, he was disgraced, and retired from court to the castle of Blois. The king being thus disappointed in his hopes respecting Italy, and being too sensible that his health was rapidly declining, turned his thoughts entirely to the internal economy of his

Disgrace of
the Duke
of Orleans.

Death and character of Charles.

kingdom, and at the same time relinquished his irregularities with regard to women, and retired with his queen to the castle of Amboise. Here, in 1498, he accidentally struck his head against the top of a door, which brought on a fit of apoplexy, of which he died in a few hours, in the 15th year of his reign, and 28th of his age. His character is admirably drawn by Comines: "He was a man of little person, and slender understanding; but so sweet in his disposition, that it was impossible to find a better temper. His widow, Anne of Brittany, was inconsolable; and two of his domestics are said to have died of grief for the loss of their master. One of the consequences of the invasion of Italy by the French, in this reign, is said to have been the introduction, among the latter, of a more refined and delicate cookery. Before this period, French cookery was distinguished by such a profusion, that their kings, more than once, were under the necessity of issuing edicts on the subject.

Louis XII.
A.D. 1498.

In Charles VIII. ended the direct line of the house of Valois; the crown on his death descended to Louis Duke of Orleans, grandson to the first Duke of Orleans. He was 36 years of age when he became king: his disposition and temper were excellent; and he was by no means destitute either of prudence or experience. He soon discovered that he was resolved to forgive the indignities he might have suffered before he came to the throne, remarking, with true magnanimity, that it was not for the king of France to revenge the quarrels of the Duke of Orleans. Louis the XII. (for so he was called) married a daughter of Louis XI.; a princess deformed in her person, and incapable of bearing children, but of excellent qualities. As, however, it was on many accounts desirable that he should have an heir to the throne, he procured a divorce from the Pope, and married Anne of Bretagne, widow of his predecessor. Soon after this marriage, he turned his thoughts to the claims which his family had to the duchy of Milan. Sforza, anticipating Louis' intentions, had made every preparation to defend his dukedom. He repaired all the fortifications, augmented his garrisons, and replenished his magazines; but he wanted the support and good opinions of his own subjects; and he had too much reason to apprehend, that whenever Louis should appear in Italy, they would desert him. The republic of Venice also, to whom some part of the Milanese territory lay very convenient, were tempted to unite with Louis, in the hope, or on the condition, of sharing in his conquests. Maximilian, who before had opposed the French in their invasion of Italy, was now on good terms with Louis; so that Sforza had every cause for despondency. Louis himself was persuaded not to lead his army in person; but to give the command to Louis of Luxemburgh, Robert Stuart, Lord D'Aubigny, and John Trevalzeo, a native of Milan. The French army amounted to 30,000 excellent troops: with these, the assistance of the Venetians, and the disaffection of the Milanese to Sforza, success beyond expectation was accomplished. Even the castle of Milan was given up. As soon as the king of France was informed of these successes, he hastened to cross the Alps, and entered the capital of his newly acquired territories. He continued three months in Milan, during which period he gave great satisfaction, by recalling those who had been banished by Sforza, remitting a fourth of the imposts, and establishing a court of justice. But, either from the natural fickleness of the Italians, from their dislike of the dominion of a foreigner, and that foreigner a Frenchman, or from some other cause, scarcely had Louis reached France, when Sforza, who had retired to Inspruck, returned, and found the gates of the principal cities of the Milanese opened at his approach. Even Milan itself received him. But his success was of short duration: He had in his pay a body of Swiss troops: these conspired against him, and delivered him up to the French, by whom he was sent to Lyons, where Louis then resided. The humanity of the king of France pleaded powerfully for Sforza, notwithstanding his repeated treachery and enormities, so that he was not put to death, but only confined in the castle of Loches, where every thing that he could wish for was granted him. Here he died after a captivity of ten years.

The French again invade Italy,

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The success of Louis with respect to Milan, induced him to extend his views to Naples: but this kingdom he could not expect to conquer without assistance; he therefore agreed to divide it with Ferdinand of Arragon: the city of Naples and the northern half were to be the portion of Louis. He also entered into a treaty with Pope Alexander VI.; but the simplicity and honour of the French monarch were no match either for Ferdinand or Alexander. The confederates indeed were successful. The King of Naples fled from his own territories; and distrusting Ferdinand, who had betrayed him, after having actually concluded a treaty of alliance with him, he threw himself on the liberality of Louis, who assigned him an asylum in Anjou, with a pension of 30,000 crowns. But scarcely was the conquest of Naples atchieved, when Louis and Ferdinand turned their arms against each other: the Spaniards began the quarrel, but the French were by no means slow in revenging the insult offered them, and Louis in a short time was so successful against his new enemies, that he might have added Ferdinand's portion of Naples to his own, had he not been persuaded to a reconcilement of their differences. In 1503, Philip, son of the Emperor Maximilian, who had married the daughter of Ferdinand, passing through France, had an interview with Louis, at which he concluded a treaty with him in the name of the King of Spain, who had granted him full powers for that purpose. By this treaty, among other conditions, the two monarchs were bound to a cessation of arms, and the provinces of Naples originally ceded, were to be guaranteed to each. As soon as the treaty was concluded, it was announced to the commanders of the French and Spanish troops in Italy. The French commander immediately offered to retire with his troops, but Gonsalvo, who commanded the Spaniards, under the pretext that Philip had acted without powers from Ferdinand, stated his determination to wait for further instructions. In the mean time he was reinforced by 10,000 Germans sent by Maximilian; and receiving information that Louis was likely to be deserted by his allies, the Pope and the Venetians, and that 4000 French troops which had been intended for their army in Naples were disbanded, under the idea of peace, he was influenced by these circumstances to attack the French general. The result of the battle of Cerignoles was the utter defeat of the French, the death of their commander, and the acquisition of the whole of Naples, with the exception of a few places. As soon as Philip was informed of this treacherous behaviour, considering his own character and honour as deeply concerned, he returned instantly to France, and placed himself in the power of the French monarch. He also remonstrated strongly with Ferdinand; his remonstrances, however, were of no effect. Ferdinand preferred power to reputation; but in order

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still to deceive Louis, he publicly offered to restore Naples to its rightful sovereign, while at the same time he sent orders to use every endeavour to expel the French. These orders were obeyed, and were successful. Louis at first took this treacherous conduct of Ferdinand very coolly; but soon afterwards he changed his feelings and his determination. He assembled three large armies, for the purpose of invading Arragon on every side, while, at the same time, a considerable fleet was fitted out, to insult the coasts of Catalonia and Valencia, and to intercept the communication between Spain and Naples. But a variety of unforeseen and untoward circumstances disappointed the hopes and the projects of Louis, while he himself was attacked by a fever that threatened his life. As soon as he recovered, A. D. 1505, he diligently applied himself to terminate a war, which had proved so unfortunate; and a treaty was at length concluded, according to which, the Neapolitan nobility, who had been the adherents of Louis, and on that account had been imprisoned by the Spanish commander, were to be released.

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Soon after this treaty, the states-general were assembled at Tours. One of their first acts was to bestow on Louis the title of Father of his people. Their next was to repair a fault that their sovereign had committed. He had promised his eldest daughter in marriage to Charles of Austria, afterwards so well known under the name of Charles V. and along with her part of the French territories. To this promise, the assembly objected most strongly, urging that the king had no right to give away any portion of the French territory. Influenced by their reasons or remonstrances, he recalled his promise, and his daughter espoused Francis, Count of Angouleme, heir apparent of the throne.

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In 1507, the city of Genoa, which was then dependent on Milan, revolted from the French. Louis resolved immediately to crush the insurgents; and for this purpose, he assembled a numerous and formidable army, forced the passes which the Genoese had occupied, and stormed their entrenchments. He then entered Genoa in triumph. But in the midst of his success, his natural mildness of temper was conspicuous, for he put to death only two of the insurgents, and levied a fine upon the city.

At this period, no monarchy in Europe was more proud than the republic of Venice; while their wealth, acquired by commerce, excited the envy and jealousy of all their neighbours. Pope Julius II. in particular, regarded this state with peculiar enmity; and influenced by this motive, he laid the foundation of the famous league of Cambray. This league was composed of the Pope, the Emperor, the King of France, and the King of Spain. Louis was induced to join in it, from the belief that the Venetians had contributed to his loss of the kingdom of Naples; but true policy should have kept under such a motive for going to war with the Venetians, as they were the only state beyond the Alps, on whose alliance he could depend. The Pope contented himself with issuing his anathemas against Venice; and afterwards repenting of the alliance which he had formed, he offered to make peace with the Venetians, if they would give up to him two places, that formerly belonged to the church. This condition the republic decidedly refused. Louis seemed most in earnest of all the confederates: he assembled a large army, and put himself at the head of it. He even crossed the Alps; those barriers which had seldom been passed without calamity, by the sovereigns of France. The valour of his troops, animated by the example of their monarch, triumphed over every obstacle. In the battle of Ghiarrada, the Venetians were defeated with the loss of 8000 men. The Pope now was active for his own benefit; immediately seizing all the towns which the republic possessed in the ecclesiastical territories. Ferdinand, on his part, reannexed Calabria to his Neapolitan dominions. At the same time, the city of Venice itself was threatened by the armies of Maximilian and Louis; and the absolute ruin of the republic seemed near at hand, when the confederates began to quarrel with each other. The senate of Venice lost no time in profiting by this circumstance, and by well-termed concessions to Ferdinand and the Pope, dissolved the confederacy.

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Julius II. now projected a more arduous and extensive undertaking than the humiliation or conquest of the republic of Venice,—he hoped, by his efforts, to expel every foreign power from Italy; and his first efforts were directed against the French, against whom he declared war, invading the duchy of Ferrara, and laying siege to Mirandola. At first the King of France was disposed to behold with contempt these efforts of the Pope. Perhaps he was retrained by religious feelings towards the head of the church; but at length, A. D. 1511, he ordered his troops to repel the invasion of Julius, and even to penenetrate into the Roman territories. Julius was soon under the necessity of retracing his steps, when the French general was suddenly seized with a mortal distemper, which gave Julius a temporary respite and advantage; but another commander having been appointed, he was again pressed so closely, that he was under well-grounded apprehensions, that it was the intention of Louis to depose him from his holy dignity. To this extremity the French monarch might probably have pushed him, had not his queen interceded and saved his Holiness.

The French invade the Roman territories, A.D. 1511.

Julius, in return for this clemency, displayed only increased bitterness and enmity against France, which he hoped to render efficient, by forming a new confederacy, called the Holy League. The principal parties of this confederacy against France, were Ferdinand, the Swiss, and the Venetians. At first their armies were successful; but the valour and skill of Gaston de Foix, a name celebrated among heroes, retrieved the affairs of France. This general, after relieving Bologna, and Brescia, and defeating the Venetians with a very inferior force, laid siege to Ravenna with the professed object of compelling or inducing the army of the confederates to give him battle. The two armies were nearly equal in numbers, being about 20,000 each. The battle was long and obstinate. The French were victorious, but their victory cost them the life of Gaston. The day was already gained, when he received information that a body of 4000 Spaniards still maintained their ground: anxious to render his victory complete, he rushed forward to the charge, with about 20 gentlemen; his horse was killed under him, and he himself, after having fought with the greatest courage, fell, pierced with wounds. The death of this hero was a fatal blow to the French, for they soon afterwards lost all the places which they possessed in Italy; their generals did not agree with each other; the king was without money; the confederates were much superior; and there was no alternative left, but to evacuate the country.

Holy League.

Battle of Ravenna.

Death of Gaston de Foix.

Louis now, A. D. 1513, was threatened with a confe-

Louis threatened with a powerful confederacy.

deracy similar to that which had so lately humbled Venice. The Pope, Leo X. was to enter Dauphine; the emperor, Champagne; the Swiss, Burgundy; the King of England, Picardy; and the King of Spain, Guienne and Languedoc. But the elements of this confederacy were too discordant long to hang together: the Pope was not fond of war; the emperor accepted subsidies, but neglected to supply an army; and Ferdinand looked to his more immediate interest, as well as to an easier enterprise, in seizing on the kingdom of Navarre. Of all the confederates, therefore, Henry, King of England, was the only formidable one that remained; and he was eager after glory: this he obtained at the battle of Spurs. But the Swiss, who had entered Dauphinè, having retreated, and the rest of the allies, as we have mentioned, having deserted the cause, the King of England, on the approach of winter, re-embarked for his own country.

Marries the sister of the King of England, and dies.

Anne of Bretagne died the following year, 1514, and Louis, in the hope of having an heir, and in order to destroy effectually the confederacy against him, married the sister of the King of England. Louis was much older than his wife; this he forgot; and in three months after his nuptials, he was seized with a violent disorder, which carried him off. In him expired the older branch of the house of Orleans, and the crown of France passed to that of Angouleme.

Character of his government.

The taxes, which had been lessened by Charles VIII., were still further diminished by Louis, while, at the same time, by a judicious mode of levying and collecting them, he rendered those which were continued less irksome and unpopular. Even in the midst of his Italian wars, he laid on no new burdens. It is true, he extended and systematized the practice of disposing of offices for money, but he carefully excepted the judicial functions from this danger and disgrace; they were always filled by men distinguished for their intelligence and virtue. The parliament of Paris not being adequate to the discharge of its duties, since it had been made sedentary, Philip the Fair and his successors had instituted several other parliaments. Louis XII. still further increased their number, and he issued an edict, by which he gave them authority to recal him to the fundamental laws of the state, if ever he discovered a disposition to evade or abrogate them;—a proof this of his wish to govern according to law, but no surety of the object which he had in view. It is said that he always kept two lists, one of the places and favours which he had to bestow, the other of the persons in each province most fit to fill or enjoy them; and on such alone they were conferred. This monarch made a wise, just, and humane distinction between those who offended him in his private character, and those who offended him as the sovereign of France: the last he punished, because he was of opinion that he thus best secured the safety and prosperity of the state; the former he suffered to pass unpunished. Perhaps in no part of his conduct did he display more good sense, or better consult the welfare of his subjects, than in the choice of his ministers; and in the case of the Cardinal Amboise, he even seems to have had the merit, or the talent, of making the same man, under him, the instrument of happiness, who, under another, would probably have been the instrument of oppression and misery.

Francis I. A.D. 1514.

As soon as it was ascertained that the widow of Louis XII. was not pregnant, Francis, Count of Angouleme, and Duke of Valois, took the title of king. He was at this time 21 years of age, full of spirit and confidence, fond of war and glory, and disposed, as well as enabled, from the circumstances in which he was placed, to give way to that propensity. Before he ascended the throne, he married Claude, the daughter of the late monarch, by Anne of Bretagne. Mary the widow of Louis bestowed her hand on Charles Brandon, Duke of Suffolk.

Prepares to invade Italy.

The first and darling object of the new sovereign, was the recovery of the Milanese; and he resolved to profit by the preparations which had been made by his predecessor; but as money was still wanting, Francis, by the advice of his chancellor Duprat, not only restored the taxes which Louis had abolished, but exposed the offices of the crown to sale, and endeavoured to augment his treasures, by means, if possible, still more unjust, impolitic, and arbitrary. As soon as he deemed himself quite prepared for the conquest, he openly avowed his determination to march against Milan. As his designs had been suspected, a confederacy had been formed against him, consisting of Maximilian, Ferdinand of Arragon, Leo X., Sforza, and the Swiss. But the character of Francis was of such a cast, that the knowledge of this confederacy, instead of leading him to drop or suspend his designs, only prompted him to their more speedy and resolute execution. As the Swiss guarded the Alps, it was necessary either to force the passes of the mountains, or to elude the vigilance of their protectors. Francis chose the latter. His soldiers, into whom he had inspired his own zeal and ardour, cut new roads; and his forces were in Italy, before his opponents thought that he had disentangled himself from the Alps. The first enemy which the forces of Francis encountered, were the papal troops, which were negligently, and securely, as they thought, encamped on the banks of the Po. On these the French poured down, so unexpectedly and with so much violence, that they were speedily and easily discomfited. Hitherto Francis had remained in his own kingdom; but as soon as he learnt of this success, he hastened to put himself at the head of his armies, leaving his mother, Louisa of Savoy, regent during his absence.

Defeats the Papal forces.

As soon as Francis assumed the command, he entered the Milanese, and pressed forward to its capital. For its protection and defence, only the Swiss troops were prepared; they were encamped about a league from the city, at a place called Marignano. Francis knew that they were brave; but he also suspected that they might be allured to withdraw from their post. His suspicions were not unfounded. An offer of 700,000 crowns made a strong impression on them, and they were preparing to yield Milan up to the French king, when they were joined by 10,000 of their own countrymen. These troops were not disposed to desert the cause in which they were embarked, and Francis found, that if Milan were to be his, the Swiss must be fought and conquered.

Battle of Marignano, Septem A.D. 151

The Swiss, probably ashamed of having listened to the offers of Francis, and resolved to wipe off their disgrace, fought with more than their usual bravery and perseverance. The battle began about four in the afternoon, in the month of September 1515, and three hours after dark, the combatants, fatigued with their exertions, separated, but only to renew the contest, if possible, with more valour and animosity next morning. For some time the issue was dubious, for the Swiss, though inferior to the French, fought only on that account more obstinately: At last they were obliged to give way; 10,000 of them perished on the field of battle; the rest fled, but in their flight they remembered their character, and no disorder or confusion was visible. The French army also suffered severely, 6000 of their troops having been killed and wounded. On this occasion Francis displayed the valour of a brave man; Charles of Bourbon, his constable, the wisdom and experience of a great commander: to him the success of the battle of Marignano is justly ascribed.

The Swiss were now tired of a contest, in the issue of which they had no immediate concern; and their army was recalled. Sforza, therefore, was left to defend his territories by his own forces alone. His cause was hopeless; but he sought to prolong his fate, by retiring into the castle of Milan. The French army, however, full of ardour, flushed with victory, and guided by the coolness and skill of the Constable, soon compelled Sforza to surrender the castle, on the condition that he should enjoy a retreat and a pension in France.

Milan taken.

It was always the policy of the Popes to be among the first to set on foot confederacies to protect Italy from the French, and among the first to desert them. Leo X. acted in conformity with this policy. He sought an interview with Francis, whom he received with a flattery which he knew would find its way to the feelings of the French monarch. After this interview, Francis returned to Lyons.

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Had not Francis been more ardent than penetrating, he would not have forsaken Italy at this moment; but he uniformly displayed, through his whole life, qualities and feelings which prompted him to enterprise, but forbade the ultimate and permanent success of his plans. Among the confederates against him was Ferdinand of Arragon. Soon after the return of Francis to his own kingdom, this monarch died. He had always opposed the designs of the French against Naples; his death, therefore, seemed to have removed a serious obstacle to these designs, which, it is probable, were still cherished by Francis. At any rate, a rival was removed, whose experience, subtle arts, and numerous resources, Francis had just reason to dread. Francis, however, did not profit by the death of Ferdinand, though his successor was only 16 years old; and by this want of foresight—for history compels us to ascribe his conduct to any other motive but a scrupulous regard to justice—not that Francis was more lax in this respect than the other sovereigns of his age,—he suffered a rival to rise up in the fulness of his strength, still more formidable than the one from whom death had just freed him. The successor of Ferdinand was Charles V.; and under him were now united a most formidable kingdom in the Old World, and territories in the New, which promised an inexhaustible source of riches.

In the mean time, the Emperor Maximilian had invaded the Milanese with an army of 40,000 men: but the Constable Bourbon, with an inferior force, obliged him to retire. Francis also made an attempt to rescue Navarre from Spain, and to reinstate on its throne its legitimate monarch; but in this attempt he was defeated, principally by the sagacity and prudence of Cardinal Ximenes, who at that time ruled Spain.

Charles V., at his accession to the throne of Ferdinand, was disposed to continue the war with Francis, especially on the side of Flanders, where he was when Ferdinand died; but the Flemings were averse to a war, which exposed them to the loss of their commerce. Francis, on his side, was desirous of securing his conquests in Italy. Under these circumstances, a treaty of peace was easily and speedily concluded at Noyon between the two monarchs. By this treaty, Francis was to give in marriage to Charles his eldest daughter, and with her resign all his pretensions to the throne of Naples. Charles, till the marriage took place, was to pay 100,000 crowns a year to the King of France, in consideration of his being already in possession of Naples; and Francis was left at liberty to support the heirs of the King of Navarre, provided they could not make out their claim to the satisfaction of Charles. Peace was thus restored for a short time; but in 1519, the Emperor Maximilian expired; and it was easy to foresee, that the election of a successor would give rise to hostilities. The probability of this event was still further increased, when it was known that Charles and Francis were competitors for the imperial dignity. They had indeed, from the first, agreed to carry on the competition with emulation, but without enmity; and Francis, with his natural and characteristic vivacity and frankness, declared to Charles, "We are both suitors to the same mistress; the more fortunate will win her, but the other must remain contented." It was, however, not to be expected that the loser would be contented. The prize was of infinitely too great value to be sought for and lost with quiet feelings. As the sovereignty at which they aimed could be obtained only by means of the electors, money and influence, not arms, were to decide to whom it was to fall. Francis was profuse in his expenditure of money on this occasion, but his influence was small. The Germans were partial to the house of Austria; and the voice of Frederic of Saxony decided the contest. Charles was raised to the imperial dignity, and Francis retired disappointed, and rankling after revenge. Influenced by these feelings, he sought and obtained the alliance of Henry of England; but Henry was of too fickle a character to be long faithful to his promises. Charles knew this, and a very short time saw the emperor and Henry united. Francis next turned his thoughts towards the Pope, who, hoping to serve his own interest, by employing one monarch to expel the other from Italy, gave encouragement to the expectations and wishes of Francis. By the German constitution, the kings of Naples were for ever excluded from the imperial dignity. According to this regulation, Charles ought not to have been elected emperor; but as his election had taken place, Leo and Francis declared that he had forfeited his right to Naples. This was one cause for war; and another was not wanting. The emperor, as king of Spain, refused to do justice to the heirs of the king of Navarre; and in this event, by the treaty of Noyon, Francis was at liberty to support them. The kingdom of Navarre received the French with open arms. Charles was taken unprepared; his forces were employed in quelling some commotions which had arisen in Spain; and Navarre seemed on the point of being completely conquered, when it was saved to Charles by the rashness of the French general, who, before he had completed the conquest, entered Catalonia, whence he was driven with disgrace, and his army afterwards defeated, and himself taken prisoner. As this war had been carried on by Francis in the name of Henry D'Albret, who claimed the kingdom of Navarre, it did not immediately occasion hostilities between Francis and Charles. In the mean time, the former was nearly deprived of his life by an accident. While he was engaged in the diversion of attacking with snow-balls the house of the Count de Pol, he was wounded in the head by a torch. For a long

Peace between Francis and Charles V.

Competitors for the imperial dignity.

Charles obtains it.

The French invade Navarre

time he was seriously ill; and, during the cure of his wound, it was deemed necessary to cut off his hair, which he never would permit to grow again, but introduced the fashion of wearing it short.

and the Low Countries.

As soon as he was sufficiently recovered, he prepared for hostilities; and, taking the field with a numerous army, spread terror through the Low Countries. Charles, on his part, was not slow in meeting his antagonist; and near Valenciennes, the two monarchs, at the head of their respective forces, were opposed to each other. A thick fog at this time prevailed, and the Constable Bourbon entreated his sovereign to take advantage of it, and commence the attack. Francis, however, jealous of the military reputation of the Constable, refused to listen to his advice, and even manifested his jealousy, by bestowing the command of the van, to which the Constable, by virtue of his office, had an undoubted right, on Charles D'Alençon, the first prince of the blood. From this period, the Constable's dislike of Francis may naturally be dated.

Nothing of consequence occurred in the Netherlands; but Charles, who trusted as much, or more, to his intrigues as to his army, contrived to engage Henry VIII. and the Pope on his side. By the treaty entered into by them, it was agreed, that the Pope and the Emperor should unite their forces, for the purpose of driving the French from the Milanese, which was to be restored to Francisco Sforza; that Parma and Placentia should be restored to the Pope, whom the Emperor should also assist in conquering Ferrara. Henry, on his part, agreed to invade France on the side of Picardy with 40,000 men, and to bestow on Charles his only daughter, the Princess Mary.

Francis loses all his Italian possessions.

As soon as Francis was apprised of the storm which threatened his Italian dominions, he prepared for their defence; but as his forces were either employed in the Low Countries, or assembling on the frontiers of Spain, he was obliged to hire a body of men from the Swiss. For this purpose, he raised a large sum of money, which, however, his mother intercepted; and, in consequence of the Swiss troops not receiving their pay, they retired from the standard of Francis. At this juncture, Milan was betrayed to the general of the Pope; the other cities of the duchy followed its example; and the castle of Milan, with a few inconsiderable forts, alone remained to Francis. This great success, however, was indirectly the cause of the dissolution of the confederacy; for Leo X. received the news with such transports of joy, as brought on a fever and occasioned his death. He had kept alive the confederacy, which expired with him. But Francis was still unable to reconquer his territories in the Milanese; and in 1522, Francisco Sforza was restored to the whole of his paternal dominions.

Resolves to march into the Milanese.

The loss of the Milanese was not the only misfortune which assailed Francis at this time. Genoa expelled the French troops, and opened her gates to the army of Charles. Henry of England openly declared war; and his forces, united with the Flemings, invaded Picardy. But the French, inferior in numbers, baffled the designs of the invaders, by adhering to the politic plan of not fighting; so that at last the English and Flemings were compelled to retreat. As soon as Francis saw that his territories were secure on the side of Flanders, he resolved to march himself into the Milanese. Before, however, he could put this plan into execution, he was alarmed by a conspiracy formed against him at home. The jealousy of the king with regard to the Constable Bourbon, has been already noticed. This nobleman, on his part, could not but feel indignant at the treatment to which this jealousy had given rise. His services, especially at the famous battle of Marignano, had never been requited; on the contrary, the king, in more than one instance, had purposely slighted him. Perhaps, however, the feelings which this conduct on the part of the king produced, would not have stirred up the Constable to rebellion, had it not been for another circumstance. The mother of Francis, forgetting her age, fell in love with him. She offered him marriage. He refused her. Her love was thus converted into the most deadly hatred and revenge. A law-suit was commenced against him for the estates, which he held in right of his deceased wife. The issue was such as might be expected; justice was set at nought, and the Constable Bourbon found himself deprived of the greatest part of his property. In this state, he began or renewed his intrigues with Henry and Charles, who gladly embraced his alliance, and formed an actual treaty with him, according to which the conquest of France was projected, and if it were effected, Provence and Dauphine were to be assigned to the constable, with the title of King. In furtherance of this plan, the English monarch was to invade Picardy; the emperor was to enter France by the Pyrenees; and Bourbon was to penetrate with an army of Germans into Burgundy, where he expected to be joined by his numerous and powerful adherents. The period for carrying these enterprises into execution was fixed; as soon as Francis had crossed the Alps, the confederates were to put their respective armies into motion.

Conspiracy of the Constable Bourbon,

which delays his plan.

As soon as Francis was informed of this conspiracy, he attempted to seize Bourbon; but he escaped, and fled into Italy. Not deeming it prudent to leave his kingdom at this juncture, he entrusted the command of the army destined for the invasion of Italy to Admiral Bonnivet, who was totally unfit for his station. The general of the Pope, however, being much inferior in force, was compelled to retire. The greatest part of the duchy of Milan submitted to the arms of France; and had Bonnivet known how to act, Milan itself must have fallen. But he delayed attacking it till it was too late; the winter set in, and Bonnivet was obliged to protect his troops from its inclemency in quarters. In Burgundy and Guienne, the success of Francis was more complete; the Spaniards and Germans were repulsed. Paris, however, was threatened by the English, who, having landed in Picardy, advanced to within 11 leagues of the capital. their career was, however, soon checked by the Duke of Vendome; and they were driven out of the French territories with disgrace.

At the commencement of the next campaign, the affairs of Francis in Italy wore a very unfavourable aspect. A numerous army of the allies threatened that part of the Milanese which the French had conquered; and Bonnivet was quite unable to contend, either with the superior numbers or the superior talents of his opponents. He was accordingly under the necessity of abandoning his entrenched camp, and crossing the river. During this latter movement, he received a wound in his arm, which obliged him to quit the field. The famous Chevalier Bayard was entrusted with the command during the absence of Bonnivet. He animated the cavalry by his presence and example, to withstand the whole of the enemy's troops; but in this service he received a

Death of the Chevalier Bayard.

wound, which he immediately perceived to be mortal. Incapable any longer of sitting on horseback, he was placed on the ground, with his face towards the enemy, and his eyes fixed on the guard of his sword, which he held up instead of a cross. In this posture, he addressed his prayers to God, and expired, regretted equally by his countrymen and his foes, as his ancestors for several generations had done, in the field of battle. Just as he was about to draw his last breath, Bourbon arrived where he lay, and expressed his sorrow at his fate—"Grieve not for me (said the hero), I die, as I lived, true to my king; but I pity you, who fight against your king, your country, and your oath!"

Italy wrest- d from Francis,

In consequence of the retreat of Bonnivet, which was continued into France, the whole of Italy was wrested from his master. The Cardinal Bourbon, eager after revenge for the insults he had suffered, as well as anxious to conquer his promised kingdom, wished to have invaded Provence; but he was restrained by Charles, who advised or commanded him to lay siege to Marseilles. In this siege, forty days were unprofitably consumed. The King of France advanced to its defence, and Bourbon retired into Italy. Francis, again elated by his success, and untaught by all the reverses which his predecessors, as well as himself, had suffered in their attempts against Italy, resolved to enter that country, and endeavour to regain the Milanese. From this attempt he was in vain dissuaded by the most prudent and experienced of his generals, as well as by his mother. He persevered, and success seemed to sanction his design. The city of Milan opened its gates; the army of Bourbon fled; but Francis did not improve his successes. He consumed the precious time in besieging Pavia, when he ought to have pursued and attacked the enemy in the moment of their consternation and flight. He was still further elated by the Pope and the republic of Florence deserting his adversary, and uniting themselves to his cause. It seemed to him as if the period were at length come, at which it was decreed that the French should be universally and permanently successful in Italy. Regarding the Milanese as secure, he dispatched 6000 men into Naples, while he himself pressed forward the siege of Pavia. This city, though defended with the utmost gallantry, must have fallen, as it was reduced to the last extremity, when an imperial army advanced to its relief.

o again ades it.

e of 1524.

The battle of Pavia decided the fate of that city and of Francis. Lannoy and Pescara, the generals who advanced to its relief, were reinforced by 12,000 Germans, dispatched by Bourbon. Still Francis would not have been unfortunate, had he either raised the siege, or continued in his intrenchments; but a false shame prevented him from adopting the first measure, and the foolish and rash advice of Bonnivet induced him to leave his advantageous position, and offer battle to his adversaries. This was what they wished for, but hardly expected. Even after the imperialists had their adversary under circumstances most favourable to themselves, their success was extremely doubtful; and, in all probability, Francis would have witnessed a drawn and indecisive battle, or at least would not have suffered such a severe and fatal loss, had it not been for the treachery of part of his own army. In the midst of the engagement, the Duke of Alençon, with the troops under his immediate command, that formed part of the left wing, went over to the enemy. About the same time, the garrison of Pavia sallied out on the rear of the French; and the cavalry of the latter, unable to withstand the imperial horse, gave way. Under these circumstances, notwithstanding the exhortations, the example, and the exertions of Francis, the rout became general. The king was himself wounded, and thrown from his horse; yet he defended himself bravely, till at length, exhausted by fatigue and his wounds, he was under the necessity of delivering his sword to Lannoy. On the day after the battle, Francis was conducted to a strong castle near Cremona, and committed to the charge of an officer of great vigilance and integrity.

Francis taken prisoner.

Vigorous and wise conduct of the Regent.

As soon as the regent Louisa was acquainted with the disastrous battle of Pavia, by a letter from her son, containing these words, "Madam, all is lost except our honour," she put forth all her talents, which had hitherto been expended on useless or dangerous objects, towards the safety of the kingdom; and that it was saved in this hour of unparalleled and imminent danger, must be ascribed to her exertions and talents. She immediately assembled the nobles at Lyons; collected the remains of the army, and recruited it so as to render it fit again to take the field; levied new troops; and, above all, endeavoured to conciliate the King of England. Henry had long been jealous, or afraid of Charles; and Wolsey had not forgotten the promises of the papal dignity, with which the emperor had deceived him. But it was evident, that whatever steps the King of England might be induced to take, immediate measures on the part of France itself were indispensably necessary; and when the storm had passed away for a little time, it was discovered that it was not in the power of the Imperialists to profit so much by the victory of Pavia as they had hoped, and France had dreaded. Lannoy found himself under the necessity of disbanding the greatest part of his army for want of money. The character of Charles in a great measure saved France; for, instead of pursuing his advantages by the same means by which he had acquired them; instead of augmenting his armies and pushing his conquests into France,—he endeavoured to gain from his royal captive, by intrigue and negociation, what he probably could have wrested by force. But Francis indignantly rejected the base and dishonourable terms, and displayed, on the occasion, such spirit, that Lannoy thought it more prudent to send him into Spain, for the purpose of a personal interview between him and Charles. But this interview, at first, was productive of no effect. Charles behaved to him with so much duplicity, and evidently endeavoured to extort from him such dishonourable terms, that Francis, in despair, entrusted to his sister, the Duchess of Alençon, a deed, by which he resigned his kingdom to the Dauphin. This circumstance at last induced Charles to behave with more openness and honour towards his captive. He was also threatened with a confederacy against him, which had for its objects to liberate Francis, and to humble and curtail the power of his conqueror. By the treaty of Madrid, Francis regained his liberty, and, as the price of it, restored Burgundy to the emperor in full sovereignty, as well as Artois and Flanders. As hostages for the regular and honourable fulfilment of these conditions, Francis gave his two eldest sons. In order to render the union between him and the emperor more binding and lasting, he was to marry the emperor's sister, the queen-dowager of Portugal, and to cause all the articles to be ratified and registered by the states. Even these terms did not satisfy the emperor; for, suspicious of the integrity of Francis, he bound him by an oath to return as a prisoner into Spain, if, within a limited time, all the stipulations were not fulfilled. It was not indeed probable, that the French sovereign

Behaviour of Charles to his captive,

who recovers his liberty on certain conditions, would himself be willing to execute such stipulations, or, if he were, that his states would permit the kingdom to be so dishonoured; and, even while he was yet at Madrid, he assembled the few counsellors in whom he could confide, and before them solemnly protested against a treaty which had been extorted from him, and which he therefore deemed null and void. The articles, however, were ratified in France, as, till that ratification arrived at Madrid, Francis was not to be at liberty to depart; but, as soon as Francis passed the boundaries between France and Spain, he mounted his horse, waved his hand over his head, and joyfully exclaimed several times, "I am yet a king!"

which he evades.

Scarcely had he reached Paris, before he disavowed the principal article of the treaty of Madrid, that by which he agreed to cede the province of Burgundy to Charles; but, in order to colour and excuse this infraction of the treaty, the deputies of that province waited on the king, in the presence of the ambassadors from Charles, and represented, that no sovereign could alienate their country from the crown, or transfer it to another, without their consent; and that, therefore, as Francis had done that, which he had no right or authority to do, the cession of Burgundy must be looked upon as void. Francis assented to these arguments; but at the same time he offered in lieu of Burgundy, to pay the emperor two millions of crowns. Charles, as might be expected, rejected the proposal; and resolved to have recourse to arms, for the purpose of compelling his adversary to fulfil the treaty of Madrid.

The Cardinal Bourbon marches against Rome. A.D. 1527.

But while the fate of Francis had excited the pity,—the ambition and power of Charles had roused the jealousy, or the apprehensions of the other European sovereigns. The Pope, the republic of Venice, and the Duke of Milan, entered into the confederacy, of which, under the appellation of the Holy League, Henry King of England was declared the head and the protector. Scarcely, however, was this confederacy formed A. D. 1527, when its dissolution appeared at hand: The Milanese, indeed, had been over-run by the Constable Bourbon; but his soldiers not reaping from the conquest of this exhausted territory all the plunder they had anticipated, he was obliged to march them against Rome. This march, perhaps as much as any of the exploits of the Cardinal, proved the greatness of his military talents: it was executed in the depth of winter, with an army of 25,000 men, destitute of money, magazines, and artillery, and in the face of a superior army; but Rome was reached; and Bourbon was on the point of witnessing the capture of the capital of the ancient world, when a random shot deprived him of life. The command of his troops devolved on the Prince of Orange; they were eager for booty, and for revenge, on account of the death of their general; and Rome became a theatre of carnage and desolation, the Pope himself being made prisoner.

The French successfully invade Italy.

But the splendour of this expedition, and its immediate success, by no means compensated for the injury which it did to the cause of Charles: the Milanese were left exposed; Catholic Europe was indignant and horrified at the treatment of the Pope; the states of Italy were wearied with the yoke of Charles, and an army sent under these circumstances by Francis, was received with congratulation and gratitude. After the French commander had succeeded in reconquering nearly the whole of the Milanese, he directed his march towards Rome, from which place, after having liberated the Pope, he resolved to proceed to Naples. The imperial army was unable to contend with him; all the Neapolitan territory, with the exception of the capital and Gaeta, submitted to the invaders; the fleet of the emperor was defeated; and the French at last seemed to have secured the object, after which they had so long and so frequently directed their efforts. But Francis' character was much better suited for rapid and splendid enterprises, than for such as required continued effort, circumspection, and foresight: Elated with his success, he forgot that his troops still must be supported and paid; he neglected or disgusted his Admiral Doria, to whose skill and valour he had been indebted for his naval victory; he even ordered him to be arrested, because, with a freedom, which the circumstances justified, which his republican birth and education might have excused, and which probably arose in some degree from his attachment to Francis, he opposed some designs of the king, which he deemed injurious to his honour, as well as to the interests of Genoa. Doria, apprised of his danger, escaped the meditated arrest, entered into a negociation with the emperor, and sailed back to Naples, which he protected and delivered. In the mean time, the discontents of the French army increased; they were in great want of provisions; constantly harassed by their opponents, and at last attacked with a contagious disorder: of this their general died; and his successor found himself under the necessity of evacuating Naples. Doria now triumphing over Francis, was resolved to effect the liberation of his native city; and as the French garrison of Genoa was reduced by desertion to a very inconsiderable number, he had soon the satisfaction of entering it, where he was hailed as the father of his country, and the restorer of its liberty.

Their advantages lost through Francis.

Genoa wrested from them.

Treaty of Cambray. A. D. 15

The dreams of conquest which Francis had indulged, being thus dispelled by his reverses, he turned his thoughts to peace; which, however, he might have found it difficult to have gained, had not Charles at this time been alarmed at the progress of the Turks, the progress of the Protestant religion in Germany, and the discontents in Spain. In consequence of this mutual disposition for peace, the treaty of Cambray was formed. Charles gave up his pretensions to Burgundy. Francis, on his part, renounced all his right to the Milanese, Flanders, and Artois, and espoused Charles' sister, the widow of the King of Portugal. He also agreed to give two millions of crowns of gold for the ransom of his sons. With this money he was supplied by Henry VIII. of England. These terms were not very honourable or advantageous to France. But the French monarch stained his reputation, by abandoning his allies, the Venetians, the Florentines, and the Duke of Ferrara, to the mercy of Charles.

Francis now had been for nine years, from 1525 to 1534, almost constantly at war. His kingdom was nearly exhausted; and not only did its finances require his care, but its internal regulations in almost every other respect. To these objects, therefore, he devoted some part of his time; but a larger portion of it was given up to luxury, the patronage of letters, and the protection of the fine arts. During this repose from war, the most important events were the annexation of the province of Bretagne to the crown of France with the consent of the states, and the marriage of his second son Henry with the celebrated Catherine of Medicis, by which union he hoped again to open a path for the entrance of the French into Italy.

Francis had never regarded the terms of the peace of Cambray, as advantageous or honourable to himself; and consequently had eagerly looked forward

Francis
reaks the
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A. D. 1535.

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for a good opportunity or excuse, in order to break them. This opportunity occurred in the year 1535, five years after the treaty was concluded. Charles, at this time, was absent on an expedition to Africa. Sforza had put to death the French agent at Milan. Thus an excuse for hostilities was afforded, as well as a good opportunity for commencing them. The Duke of Savoy, however, refused permission to the French to pass through his dominions; but he could make no effectual resistance. Savoy itself was soon conquered; and Piedmont alone remained to the Duke. Sforza, alarmed at the approach of the French army, is said to have expired with terror; and every thing seemed to promise a rapid fulfilment of the wishes of Francis. Again, however, he was destined to be disappointed. The Pope would not second his enterprise. Henry of England offered to support him, but on the condition that Francis should, like him, throw off the papal supremacy. To this condition, Francis refused his assent. The Protestant princes of Germany, to whom, as the natural opponents of Charles, he next turned his attention, renounced his alliance, because he persecuted their brethren in France. He therefore was convinced, that on his own resources and vigour alone he must depend in his war with Charles. But this consideration failed of producing corresponding conduct. Instead of profiting by the unprepared state of Charles, he suffered himself to be duped by his professions. At last he saw his folly. While the emperor was amusing him with the hope that the Milanese should be restored to France, he entered Piedmont with an army of 40,000 infantry, and 10,000 cavalry. This country soon yielded to him; and Francis next saw him direct his attention and his march against the southern provinces of his kingdom. On this occasion, Francis conducted himself with a degree of prudence, which could not have been expected from his sanguine disposition. Instead of marching to the frontiers to give his opponent battle, he resolved to act entirely on the defensive; to garrison the strongest towns; and to lay waste the country as the enemy advanced, so as to deprive him of subsistence. This plan was entrusted to Montmorency; and to no fitter person could it have been entrusted. He acted strictly according to the directions and the design of his sovereign. Charles advanced into Provence; but he found it deserted and desolate. There were no inhabitants, no cattle, no grain. The open towns submitted, but the fortified places resisted. Before one of these, the French general had encamped his army; but in such a situation that he was invincible, and the town was safe, unless the emperor could tempt or provoke him to give battle. This Montmorency cautiously avoided. For two months, Charles besieged the town; but he made not the least progress, while famine and disease thinned his ranks, and dispirited his troops. At last he was compelled to retreat. Now Montmorency came forth, and hung upon the rear of his opponent. Perhaps the emperor and his army might have been totally destroyed; but the French general, even under the most favourable circumstances, would not depart from his plan, and hazard a battle; declaring that a bridge of gold ought to be made for a flying enemy.

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About the same time that Charles entered Provence, another of his armies invaded Picardy; but it was equally unsuccessful. Francis now was at the height of his prosperity: His great rival was defeated and disgraced: His dominions were proved to be invulnerable when properly defended. He himself had gained prudence and experience: The rashness and folly of youth had yielded to the cool and comprehensive wisdom of age; but in the midst of these flattering circumstances, a most poignant disaster overtook him,—the dauphin died suddenly, not without suspicion of being poisoned.

Interviews between Charles and Francis.

In the beginning of 1537 a curious scene was exhibited, which seems to prove, that the natural foibles of Francis' character were too deeply implanted to be entirely extirpated by age and experience. He summoned the emperor to appear before the parliament of Paris, to answer as his vassal for the counties of Artois and Flanders; and on his refusal, declared them forfeited to the crown of France. He even marched into the Low Countries; but either not being sincere, or not able to carry his purpose into effect, a suspension of arms was agreed upon, which was afterwards followed, A. D. 1538, by a truce for ten years. Shortly after this truce was agreed upon, Charles, on his voyage to Barcelona, was driven to take refuge in a small island on the coast of Provence. As soon as Francis heard of this, he proposed a personal interview, to which the emperor consented; and thus these two rivals, after twenty years of hostilities, met each other, and vied in expressions of respect and friendship.

Charles agrees to cede the Milanese,

In the following year they had another interview. In consequence of the revolt of the people of Ghent, it was necessary for Charles to pass into the Netherlands from Spain. As expedition was necessary, he did not wish to pass through Germany, in which country he must have travelled with so much ceremony and pomp, as must have delayed his progress. He did not like the uncertainty and risk of a voyage; he therefore resolved to pass through France; and, in order to induce Francis to permit this passage, and not to take advantage of it, by detaining him, he represented to that monarch, that he would cede the Milanese to him. Francis agreed to the proposal, and received and treated Charles with the utmost respect and magnificence, during his six days abode in Paris. A bon mot of Triboulet, the fool at the court of Francis, on this occasion, is recorded: He wrote on his tablet, that Charles was a greater fool than himself, thus to expose himself in passing through the territories of his rival. "But what will you say, (observed Francis,) if I let him pass unmolested?" "I shall efface his name, and put yours in its stead," replied the fool.

but breaks his promise.

As soon as the emperor had arrived in Flanders, the ambassadors of Francis required that the Milanese should be restored to their master. At first Charles gave no direct or decisive reply, till at last having reduced the Flemings to submission, he boldly averred that he had never given any promise to restore the Milanese. Francis was completely ashamed at his own folly, in thus being the dupe of the emperor, and at the same time was filled with indignation and the spirit of revenge; but he could not immediately commence a war, for, by his interview with Charles, he had excited the suspicion, or produced the indifference, of the king of England. The pope seemed resolved to maintain his neutrality. The sultan alone listened to his schemes of revenge and warfare. Still, however, Francis could scarcely feel himself justified in the eyes of Europe to commence hostilities, merely because the emperor had given him a loose promise to restore the Milanese, and had not kept that promise; but a more solid reason was not long wanting. Two French ambassadors were assassinated by order of the Milanese government. This was amply sufficient, in the spirit in which Francis had long been: He demanded instant and full satisfaction for their death; he was evaded and refused; and he resolved on instant war. Scarcely had Charles returned from a second expedition into Africa, A. D. 1542, when five formidable French armies entered his dominions. Spain, Piedmont, Brabant, Flanders, and Luxemburgh, were at once the scene of war. The Duke of Orleans reduced the greater part of Luxemburgh; the dauphin laid siege to Perpignan: but, on a report that the emperor was advancing to its relief, the duke abandoned his conquests in Luxemburgh, and hastened to support the dauphin. Perpignan was defended by the Duke of Alva, who had instructions from his master to hold out to the last extremity, as it did not enter into his plan to raise the siege. The event proved that Charles was wise in his determination; for three months the French endeavoured to reduce it, but their troops fell before fatigue and disease; and after that period, they were under the necessity of retiring from before it. The armies of Francis were equally unsuccessful in their other attempts against the dominions of the emperor, so that he saw his vast preparations rendered utterly useless.

Francis makes war on him. A. D. 1542.

The year 1543 was distinguished by few events of moment. Rochelle had revolted, but it was soon reduced. Luxemburgh was occupied by the armies of Francis; and the city of Nice was besieged by that monarch, in conjunction with his ally the sultan: but this alliance was by no means prudent or politic, as it gave great offence to those who might otherwise have united with Francis, that he should have allied himself to an infidel; and this evil consequence of his alliance was not counterbalanced by success, for Nice was not reduced. The year 1544 was distinguished by the battle of Cerizoles. The young Count D'Enghien, had penetrated into Piedmont, where he was opposed by the imperial general the Marquis del Guosto. The armies met at Cerizoles, and the Imperialists were defeated; but the victory of the count was of little avail. The emperor, and Henry of England, (who at length had taken a decided part against Francis,) had entered Picardy with two numerous armies; and, as Francis was by no means equal in force to his opponents in this quarter, the count was obliged to abandon the fruits of his victory in Italy, and hasten to the north of France. At no period were the affairs of the French monarch, to all appearance, more desperate than at this period. The force of his enemies was so powerful, and his own means of resisting that force, or delaying its progress, so inadequate, that had Charles and Henry united their armies, Paris, in all probability, would have fallen: But they were not men likely to agree long in opinion; besides being suspicious of each other, they were both obstinate in their dispositions. Charles wasted his time in the siege of St Dizier, while Henry's immediate interest directed him against Boulogne. From these attempts neither of them would desist, even though they must have perceived, that if they gave them up for the present, Paris would be their immediate reward, and St Dizier and Boulogne would not long hold out after the capital was reduced. At this crisis, Francis, who had been long unable, from illness, to head his armies, committed the command of them to the dauphin, who was not insensible to the dangers and difficulties of his situation, but who conducted himself, on this occasion, with considerable skill and prudence. St Dizier was bravely defended; nor would it have fallen if artifice had not been employed. On its reduction, though the emperor's army was considerably weakened by the losses he had sustained during the siege, he resolved to penetrate still farther into France. Champagne was invaded, and Chateau-Thierry was taken,—a place within two days march of Paris. The fate of the capital seemed inevitable, when the dauphin threw himself between it and the enemy; but he still cautiously avoided a battle, contenting himself with incessant skirmishes, and with depriving the enemy of the resources of the country. This plan had its desired effect: Charles, straitened for forage and necessaries, listened to terms of accommodation, and a definitive treaty was signed at Crespy. By this treaty, Francis resigned his acquisitions in Piedmont and Savoy; and the emperor engaged, in the space of two years, to grant his daughter or his niece in marriage to the Duke of Orleans; and, as a portion, to give up either the Low Countries or the Milanese. It is evident, that this treaty, like the rest which Francis had entered into with his opponent, was favourable to the latter, in so far as the cessions to him were immediate and certain; and of doubtful advantage to the former, in so far as it contained merely a promise of a future cession to him: while, by such arrangements, reasons for future warfare were supplied.

His affairs desperate.

Treaty of Crespy.

While the negociations between the Emperor and Francis were going on at Crespy, Boulogne had fallen into the possession of the king of England; and as that treaty contained no stipulation respecting Charles' ally, it was necessary for Francis to recover Boulogne, either by force or negociation. He chose the former, and sent an army, under the Duke of Orleans, for that purpose. But, at a place between Abbeville and Montreuil, the duke died, and the enterprise was abandoned. The insincerity of Charles in this condition of the treaty of Crespy, was immediately made manifest; for he declared that the death of the Duke had freed him from all his agreements respecting the Low Countries, or the Milanese.

The Count D'Enghien did not long survive the Duke; and the mind of Francis, already weakened by his long and severe illness, sunk before the impression of these calamitous events. Even an advantageous peace with England did not mitigate his grief, and renew his energy; for it was more than counterbalanced by the enmity and intrigues of his own mistress, the Duchess D'Estampes, and of Diana de Poitiers, the mistress of the Dauphin, who divided the court into open and implacable factions. The death of Henry of England, which happened in 1547, also preyed on the mind of Francis, as he had long known and personally loved that monarch. In this state of grief and despondency, he wandered about from place to place, in the vain hope of restoring his health of body, or recovering his tranquillity and firmness of mind; at length he died at Rambouillet, in the 53d year of his age, and 32d of his reign.

The character of Francis was strongly marked. One of the distinguishing features of his mind was promptitude and decision: his quick perception, and his great activity, led him to resolve instantly, and to follow up his resolutions by vigorous action; but he did not persevere; difficulties, which at first only prompted him to greater efforts, if they were of long continuance, and especially if they did not promise any thing splendid in their overcoming, soon wearied him out. Thus he often abandoned his first designs, and relaxed from his original vigour,—often through impatience, and sometimes

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Character of Francis.

through mere fickleness. His courage was undoubted; but it was rather courage which could act than support; which rose above the greatest dangers, if they called for activity and exertion, but which cooled, if these dangers were to be shunned or endured rather than overcome. He possessed wonderful quickness and activity of mind, which often enabled him to foresee and defeat the more secret plans of the Emperor; but which, at other times, were rendered comparatively useless in this view, from the thoughtlessness of his disposition and the warm sincerity of his heart. His mode of carrying on war was stamped by the peculiarities of his character. At the commencement of a campaign, he darted on his enemy with all his force, and endeavoured to attain his object, by the decision and rapidity of his first movements; but he seldom had any regular and comprehensive plan of warfare, the consequence of which was, that with whatever appearance of ultimate and permanent success he commenced hostilities, he generally found himself, at the end of the campaign, in a much worse condition than he had been at the beginning of it.

It will appear from this sketch, that his faults as a sovereign were of that nature which seldom fail to captivate the multitude, as they all proceeded from a frank disposition and a generous heart. Indeed his subjects seem to have overlooked his failings, and the consequences on their tranquillity to which they gave rise, in the splendour of his talents and amiable qualities. It may, perhaps, be with strict justice asserted, that Francis is the first gentleman, in the strict and most honourable sense of the word, of whom we have any record: there was a polish about his manners, an amiableness about his more common actions and his mode of performing them, and a delicacy and strictness of honour about his whole conduct, which characterise the real gentleman. To the period of his reign, therefore, we may justly trace those features in the character of the higher society in France, for which it was so long and so justly celebrated in Europe. Anne of Bretagne had begun to introduce ladies at court; but it was not till the reign of Francis that they appeared there regularly, or that they were considered as an essential part of it. The consequences were soon experienced; they insensibly gave a softness and a polish to that rudeness of manners, which the comparative ignorance and barbarism of the age, as well as its martial habits, necessarily generated. To the reign of Francis, we may also trace that spirit of intrigue, both political and personal, which long distinguished the French court, equally with the polish of their manners. In short, those who are desirous of detecting the germ of many of the characteristics of the manners of French high life, and of the maxims and practices of the court, such as they existed before the revolution, ought carefully to study the reign of Francis I.

It was during this period, that the religious disputes commenced, which afterwards agitated France so generally, and gave rise to such long and bitter civil wars. Calvin was a native of Noyon in Picardy, and was protected by Margaret of Navarre, sister of Francis: these circumstances had some influence in causing his tenets to take root and spread in France. But those who embraced them soon became the objects of persecution. Francis at one period (as has been already mentioned) was desirous of uniting himself with the Protestant Princes of Germany, against the Emperor Charles; but fearful of awakening the indignation of the Roman pontiff, and the prejudices of his people, by his negociations with avowed heretics, he seized the first opportunity to prove the soundness of his faith, by ordering six of his subjects, who had embraced the Protestant religion, to be publicly burnt; he himself being present at the execution, and declaring, with his usual and characteristic vehemence, that if one of his hands were infected with heresy he would cut it off with the other, and would not spare even his own children if found guilty of that crime. Even before the time of Calvin, it appears that the French had imbibed the reformed religion; for the inhabitants of Cabrieres and Merindol, small towns in Provence, followed the opinions of the Waldenses; and on this account the Parliament of Provence issued against them a decree, so barbarous and cruel, that the execution of it was suspended by orders from the court. But some years afterwards, in 1545, from what cause is not known, it was carried into execution by the Cardinal de Tournon, a man of a most cruel and bigotted disposition. At this period, part of the French army was returning from Italy; and these were employed against the defenceless inhabitants of Cabrieres and Merindol, 3000 of whom, without distinction of age or sex, are said to have been massacred. Nor was this barbarous work confined to these places; twenty-two other villages or towns were reduced to ashes, in the vain hope of utterly extirpating the heresy.

Henry II. A. D. 1547.

When Henry II. son of Francis I. mounted the throne, he was 29 years of age. One of the last and most urgent commands or requests of the dying Francis to his son, was, that he should never recal the Constable Montmorency, and that he should, by all means in his power, repress the ambition of the family of Guise. Henry, however, was inattentive to the injunctions of his dying father. The Constable Montmorency was recalled and loaded with honours; and the house of Guise were entrusted with his confidence. Henry did not long remain faithful to his wife Catherine of Medicis; indeed it would appear, that at this period she either did not possess, or exercise, those qualities and seducing arts for which she afterwards became so famous; since her husband deserted her, and gave himself up, a blind and willing slave, to Diana de Poitiers, whom he created Duchess de Valentinois, though she was 20 years older than himself.

Before Henry had ascended the throne, his Queen had brought him a son, who was named Francis. In 1548, on the death of James V. of Scotland, Mary his daughter, then an infant, succeeded to the throne of that kingdom. Taking advantage of this circumstance, the ministers of England endeavoured, by force of arms, to obtain for Edward VI. the hand of the infant Queen of Scotland. This the ministers of Mary resisted, and the King of France sent a powerful army to the support of his ancient allies. In return for this assistance, the Scotch entrusted their Queen to the French admiral, on his return to France; and soon after her arrival in Paris, she was betrothed to the Dauphin.

Rebellion in Guienne. A. D. 1549.

In 1549, a dangerous rebellion broke out in the province of Guienne; and, as Montmorency and the Duke of Guise were the most confidential ministers of the King, they were dispatched to quell it. Their conduct on this occasion was diametrically opposite: the constable endeavoured to repress the rebellion by the most violent and cruel measures; while, on the contrary, the Duke of Guise reclaimed the insurgents by his conciliating address, and lenient measures. To this line of conduct he was probably led, by that ambition which afterwards so decidedly marked the character of his fa-

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mily. To obtain the objects of this ambition, it was necessary that they should become popular; and the Duke, by his measures in Guienne, undoubtedly acquired great popularity. The reformed religion at this time was making certain, though not very rapid progress in some parts of France. The King was naturally of a mild temper, and a humane disposition; but these qualities were not sufficiently strong or enlightened, to withstand the blind and intemperate zeal of the age; and Henry commanded a number of proselytes to the new doctrines to be burnt in his presence.

The following year, Henry, by the advice of his ministers, directed his attention to the recovery of Boulogne from the English. It is not improbable, that if he had gone to war with this object, he might have been successful, as the English councils, during the short reign of Edward VI. were weak and distracted; but this very circumstance induced him to hope, that, by means of negociation, he should succeed with even more certainty, and with much less expence and trouble. He accordingly opened a negociation with the ministers of Edward for the restoration of Boulogne; and on his offering 400,000 crowns, they immediately accepted it, and surrendered this important place. A formal peace was soon afterwards concluded between France and England, in which Scotland was included.

Boulogne purchased.

It was scarcely to be imagined, that the long and arduous struggles in which Francis I. had been engaged with the Emperor Charles V. should not have made an impression on the mind of Henry, and led him to regard that monarch almost as his hereditary and natural enemy. His personal feeling was strengthened and confirmed by political motives and views. The treaty of Crespy could not be regarded as advantageous or honourable to France. The only provision in it, which in the smallest degree bore this appearance, related to the Duke of Orleans; and even had he survived, and had Charles fulfilled this provision respecting him, the crown of France could only have been indirectly benefited: but there was too much reason to suspect, that Charles never intended to fulfil this part of the treaty, and at any rate, by the death of the Duke of Orleans, he publicly declared, that he was no longer bound by it. Henry, therefore, considering the treaty of Crespy as injurious to his interest, was not sorry that Charles, by refusing on the plea of the Duke of Orleans, to fulfil his part of it, had afforded him a very fair pretext openly to protest against it. This he accordingly did, and immediately afterwards prepared for war. His great object was the reconquest of the possessions which the French formerly held in Italy; and the state of that country filled him with the hope, that he should attain that object. The duchy of Parma had been given to Octavio Farnese, the grandson of Pope Paul III.; and Julius III. on his accession to the apostolical throne, had at first confirmed him in the possession of it. But he withdrew his support, and revoked his grant, as soon as Gonzaga, governor of Milan, a sworn enemy of the house of Farnese, prepared, by permission of the Emperor, to make himself master of Parma. In this critical emergency, Octavio applied to Henry, as the only prince powerful enough to protect him against Charles, and at the same time disposed, both from his antipathy to Charles, and his anxiety to re-establish himself in Italy, to afford him support. Henry having not only settled his own domestic concerns, but brought his transactions with the two British kingdoms to such an issue as he desired, was at complete leisure to pursue the measures, which his hereditary jealousy of the Emperor's power naturally suggested. He accordingly listened to the overtures of Octavio; and, glad of an opportunity of gaining a footing in Italy, furnished him with what assistance he desired. The army which Henry sent into Italy, was commanded by the Marshal Brissac. The imperial troops were under Gonzaga. Still, however, the two monarchs issued no declaration of war, but, on the contrary, affected to maintain inviolably the treaty of Crespy. The war of Parma, as it is called, was distinguished by no memorable event. The army of France ravaged part of the ecclesiastical territories, while the Imperialists penetrated to the gates of Parma; but they were obliged to relinquish the siege of that city with disgrace.

Henry prepares for war with Charles.

At this period, the council of Trent was summoned to meet; but the alarm occasioned in Italy by the war, prevented most of the Italian prelates from repairing to it on the day appointed, so that the legate and nuncios found it necessary to adjourn to a future day, hoping that such a number would then assemble, as would enable them to begin their deliberations. When that day came, the French ambassador demanded audience, and protested, in his master's name, against an assembly, called at such an improper juncture, when a war wantonly kindled by the Pope, made it impossible for the deputies from the Gallican church to resort to Trent in safety, or to deliberate concerning articles of faith and discipline with the requisite tranquillity. He declared, that Henry did not acknowledge this to be a general œcumenic council, but must consider and would treat it as a particular and partial convention. The legate, however, affected to despise the protest of the King of France; the prelates proceeded to determine the great points in controversy; and the Emperor, by his authority and countenance, endeavoured to establish the competency and jurisdiction of the assembly. It is unnecessary here to particularize the proceedings of the council of Trent. They were so directly against the Protestants, that Maurice of Saxony, and the other Lutheran princes, who, under the promise of liberty of conscience, and other advantages, had been induced to assist the Emperor against the confederates of Smalkalde, were now made sensible that they had been duped by him, and that by their own force alone, could they expect to preserve the religion which they had embraced, from persecution and probable ruin. But Maurice, who, from his superior talents, as well as his superior power, took the lead among the Lutheran princes, was fully convinced, by his knowledge of the character of the Emperor, that it would be absolutely necessary to proceed with the utmost degree of circumspection and caution, so as to excite no suspicion, till all his measures were taken, and his scheme was completely ready to be carried into full execution. By his former conduct he had lost, in a great measure, the good will and confidence of the Protestants. These it was necessary for him to regain; but while he was regaining them, it was equally desirable and necessary, though still more difficult, to retain the good will and confidence of the Emperor. In the execution of his enterprize he succeeded most thoroughly, conducting an intricate plan of policy in such a manner, as to deceive the most artful, experienced, and suspicious prince in Europe. Having negociated a new confederacy of the Protestants, of which he was appointed the head, it became necessary to strengthen that confederacy by every means in his power. With this view, Maurice turned his thoughts to the King of France. There could be no doubt that Henry would most chearfully embrace any plan, the object of which was to curtail the power and influence of the Emperor, provided his religious opinions did not create an objection. These, therefore, it was necessary to consider in the negociation. It was also necessary for Maurice to anticipate and obviate any scruples or jealousies, which the Protestant princes of Germany might feel on forming an alliance with a prince, who was not only a Catholic, but who had already persecuted the reformed religion in his dominions. The repugnance and scruples of both parties, however, were overcome by the wisdom and policy of Maurice; and a treaty was concluded between Henry and the Protestant confederation.

Henry enters into a treaty with them.

As soon as the preparations of Maurice were completed, and he had assembled his army amounting to 25,000 men, he published a manifesto, containing his reasons for taking arms; to secure the Protestant religion; to maintain the constitution of Germany; and to deliver the Landgrave of Hesse from his protracted and unjust imprisonment. To this the King of France, in his own name, added a manifesto, in which he assumed the extraordinary appellation of "Protector of the liberties of Germany, and its captive princes."

As the Emperor was totally unsuspicious of the intentions, and uninformed of the hostile preparations, of the Protestant confederates, and of Henry, he was not in a condition to oppose such formidable enemies. Lorraine was immediately invaded by the French armies. The young Duke Charles, the nephew of the Emperor, was seized. Toul, Verdun, and Metz were occupied. Nor was Charles, even after his first surprize, able to oppose the conquest of Lorraine by the French; for, while they were thus rapid and successful in this quarter, Maurice marched directly towards Inspruck, where the Emperor was, hoping to surprise him in that open town. But in this he was disappointed, as Charles, informed of his danger a few hours before the arrival of the enemy, hastily fled; nor did he stop till he arrived at Villach in Carinthia.

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Charles now found himself under the necessity of dividing his enemies, in order to save himself from ruin. He accordingly agreed that the king of the Romans should meet Maurice at Passau, where, after considerable delay and difficulty, in the month of July 1552, the memorable treaty of Passau was signed, by which the civil and ecclesiastical independence of the German princes was secured. In this treaty, however, the confederates totally overlooked the services of Henry, and the union they had formed with him. There appears, indeed, to have been some reason for this forgetfulness of their ally; since his measures and operations, though undoubtedly such as weakened Charles, seemed too openly directed to his own aggrandizement, even at the expence of the Germanic empire. For Henry had endeavoured, by artifice, to possess himself of the city of Strasburgh; and had he succeeded in his attempt, the navigation of the Rhine would have fallen into his power. But he was compelled to desist, by the interference of the German princes, and the Swiss cantons.

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As Metz, Toul, and Verdun, which Henry had conquered, formed the barrier of the empire on the side of France, Charles was deeply affected by their loss; and as soon as he had concluded the treaty of Passau, he resolved to employ the most vigorous and powerful measures for their recovery. He therefore left his retreat at Villach, and put himself at the head of the forces, which he had assembled against the confederates. This army amounted to 60,000 men. At first, in order to conceal his real object, he circulated a report, that he intended to lead it into Hungary against the Turks; and when the line of his march unequivocally proved that such was not his intention, he pretended that he was marching, in the first place, to chastise Albert of Brandenburgh, who had refused to be included in the treaty of Passau. Henry, however, was not deceived; but guessing at the true object of the emperor's armament, he resolved vigorously to defend his conquests. As it was easy to foresee that the reduction of Metz would be the first object of the emperor, Henry resolved that it should be defended in the best possible manner. He therefore appointed to the command of it Francis of Lorraine, Duke of Guise. No fitter man could possibly have been chosen for this arduous enterprise. He was full of military ardour and zeal; anxious to distinguish himself, and to be classed among the heroes of France; delighting in bold enterprises, and aspiring after fame by splendid and extraordinary actions. These qualities, however, had they not been united with others more solid and useful, though not so dazzling, would, perhaps, have prevented his sovereign from making choice of him on this occasion. But he was no less distinguished for sagacity and presence of mind, than for zeal and enthusiasm. To this nobleman the defence of Metz was intrusted; and he received the commission with joy. His zeal and enthusiasm were hardly necessary to induce many others of the French nobility to offer their services, so that Metz soon saw within its walls, some of the best blood of France, which, if necessary, would be most chearfully shed to preserve it to the French kingdom. As soon as the Duke of Guise entered the place, he carefully examined it: it was of great extent, ill fortified, and the suburbs large. These defects, therefore, it was absolutely necessary immediately to remedy. For this purpose, the Duke ordered the old fortifications to be repaired with all possible expedition, even assisting and animating the labourers by his example. The officers and soldiers thus encouraged, chearfully submitted to the most severe toil. After repairing the old fortifications, the Duke directed his skill to the erection of new ones. The suburbs were levelled to the ground, in order that they might not favour or protect the approaches of the enemy; and with a similar object in view, he gave orders that the country, for several miles round, should be laid waste. At the same time, he filled the magazines with provisions and military stores, and compelled all useless persons to leave the place; yet such were his popular talents, and his power of acquiring an ascendency over the minds of men, that the citizens not only refrained from murmuring, but seconded him, with no less ardour than his soldiers, in all his operations; even in the ruin of their estates, and in the destruction of their public and private buildings.

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The Duke of Guise opposes him.

Defends Metz.

In the mean time, Albert of Brandenburgh entered Lorraine, with 20,000 men, seemingly with an intention to join the French. The emperor, notwithstanding the vicinity of this army, and the advanced season of the year, for it was now the month of October, resolved to lay siege to Metz, contrary to the advice of his most experienced officers. One of his first attempts was to secure the co-operation, or at least the neutrality of Albert. This he affected, by coming up to his price, and he joined the imperial army. The emperor now flattered himself that Metz would be soon reduced; but he was most lamentably mistaken. The winter set in with unusual rigour, in little more than a month from the commencement of the siege. The imperial camp was exposed to almost constant alternations of snow and rain, which, of course, produced disease even among the hardy Germans; while the Spaniards and Italians, accustomed to more genial climates, were rendered still more sickly and ineffective. In vain the generals and officers endeavoured to animate and rouse their men; their exhortations, their threats, their example, scarcely produced any effect. When they were ordered to advance to the assault, they remained motionless and silent. The emperor, blinded by his obstinacy to the cause of this conduct in his soldiers, retired to his tent, complaining that he was deserted by them, and upbraiding them with disaffection or cowardice. In vain did his generals endeavour to persuade him to give up the hopeless and fatal enterprize; in vain did they represent to him, that he was his own enemy, in weakening and dispiriting that army, which, though it was not equal to the task of reducing Metz, so defended, at such a season of the year, might yet, if not totally destroyed in organization, strength and spirit, be adequate to the atchievement of such conquests as would compensate for the loss of Metz. Charles was still obstinate, even when he must have lost all hope; nor did he raise the siege, till after the lapse of 65 days, spent in fruitless efforts, and after the loss of 35,000 men. Metz, notwithstanding, was very near falling into his power, by a conspiracy of monks. The superior of the cordeliers of that city was a man of a bold and intriguing spirit, and warmly attached, either from habit, or principle, or interest, to the cause of the emperor. This man, by his address, had contrived to insinuate himself into the good graces and confidence of the governor, and then treacherously formed a design to deliver up the town to the enemy. The monks of his monastery being privy to his plan, he introduced into it a number of soldiers disguised as cordeliers, who were to open the gates to the garrison of Thionville. The plot was so well concealed, that it was not discovered or suspected till the very day on which it was to be executed. On its discovery, the superior was condemned to death, with twenty of the monks. Before the sentence was to be carried into effect, the criminals were put into a cell, for the purpose of confessing one another; and in this place they murdered the superior, and beat to death five of their brethren, who had been chiefly instrumental in seducing the rest.

Charles obliged to raise the siege, A. D. 1553,

after dreadful loss.

When, at length, Charles found himself under the painful necessity of raising the siege of Metz, A.D. 1553, his army resembled rather an assemblage of worn out, diseased, and undisciplined people, than those troops which he had always been accustomed to bring into the field, and with which he had advanced against this place. He was compelled to abandon a large proportion, who were utterly unable to keep up with the main body, on account of their debility; while others, no longer under discipline, fell behind, either for the purpose of plunder, or to throw themselves into the hands of the enemy, from whom they expected the infliction of less misery than they had suffered during this unfortunate siege. Under these circumstances, the Duke of Guise might easily and safely have increased the disorder and the loss—perhaps have pressed on, almost to utter destruction, the army of his opponent: but either from motives of policy, or from the influence of humanity, he did not take all the possible advantages of his success. On the contrary, his attention and care were almost exclusively directed to heal the wounded, and restore the famished; and those who recovered he sent home, under a safe escort, and with money to bear their charges; so that the courage and skill which he had displayed during the siege were paralleled, if not exceeded, by his humane treatment of his prisoners.

The misfortunes of the emperor were not confined to Germany. In Italy, the Sienese threw off the imperial yoke; and the fleets of Solyman, the ally of the King of France, struck consternation into the city of Naples; so that, had the latter been able to have invaded Italy at this juncture, it is probable he might have regained his footing in that country.

The disgrace which his army had suffered before Metz, sunk deeply into the bosom of Charles; and he resolved to wipe it away by a most powerful effort. For this purpose he invaded France, with a numerous and well appointed army, and laid siege to Terouane, the fortifications of which were out of repair. It was, however, defended with great courage by D'Esse; but after his death, the Imperialists pressed the siege with increased vigour, and it was soon taken by assault. Charles immediately ordered the fortifications to be raised, and the inhabitants to be sent into the neighbouring towns. He then hastened his army, which he had placed under the command of Emanuel Philebert, the Duke of Savoy, towards Hesden, which was also carried by assault, though Henry himself, with a strong force, advanced to its relief. Charles, however, carefully avoided an engagement; notwithstanding the French threatened to lay siege to Cambray, and the latter were under the necessity of retiring without accomplishing the object for which they had advanced.

In A. D. 1554, Henry beheld his rival's power, already too powerful for the repose of France, still farther augmented, by the marriage of his son Philip with Mary of England. But this event only served to increase the jealously, without intimidating the King of France. He immediately augmented his forces, and resolved, by carrying on the war in Italy and the Low Countries at the same time, to compel the emperor to listen to equitable terms of peace, before the English sent any large reinforcements to him. Three large armies were accordingly equipped, with which he invaded and laid waste the provinces of Hainault, Liege, and Artois, reduced Marienburgh, took Dinant and Bouvines by assault, and invested Ronti. Charles was now broken down by years, fatigue and illness; yet, on hearing of the rapid march of the French, he put himself at the head of his army, and advanced to the relief of Ronti. Henry did not avoid the conflict; an obstinate skirmish took place. The imperial army suffered the loss of a considerable number of men and artillery. The Duke of Guise behaved in a manner worthy his reputation; and had the constable Montmorency acted with skill, vigour, activity, and courage, it is highly probable that the imperial army would have been completely routed; but the latter was jealous of the talents and fame of the Duke, and, influenced by these dishonourable motives, he would not second his efforts. The consequences were, not only that the imperial army escaped with comparatively little loss, but the French themselves were soon afterwards under the necessity of retiring. Charles was not slow in taking advantage of these circumstances. Immediately on the retreat of his opponents, he entered Picardy, where he retaliated the ravages which the French had committed in Hainault, Artois and Liege.

Henry invades the Netherlands. A. D. 1554.

The French obliged to retreat;

In Italy, the French were equally unfortunate: their army there was placed under the command of Strozzi, a Florentine exile, who was defeated with the loss of 4000 men, in the battle of Marciano, by the Marquis de Marignano, general to Cosmo de Medicis. The Imperialists, fully sensible of the advantages that might be reaped from this defeat, immediately laid siege to Siena.

their misfortunes in Italy.

which was garrisoned by French troops, under the command of Montluc. This commander did all in his power to protract the loss of the place; for 10 months he defended it with the greatest gallantry; nor is it likely that it would ultimately have fallen, had it not been for the ravages which famine committed among the garrison. The Imperialists did justice to the valour of the besieged, in the terms which they granted to them, Montluc, with his French troops, being allowed to march out with all the honours of war.

More successful in Piedmont.

In Piedmont, Henry was more successful. His army there was under the command of the Marshal Brisac, who was opposed to the Duke of Alva. Notwithstanding the great talents of his rival, and the equally discouraging circumstance, that his troops were inferior in numbers to the Imperialists, he not only baffled the Duke, who had boasted that he would soon compel him to retreat into France, but he even penetrated into that part of the country which the emperor had hitherto preserved; and, in all probability, would have extended his incursions farther, had not the jealousy of the Guises and the Constable Montmorency operated in cutting off his supplies.

About this period the Emperor had come to the determination of abandoning his throne, and spending the remainder of his days in retirement. To this determination he was probably led by witnessing the decline of his military glory, and by having felt the weight of age and disease. He was also disappointed in the death of Pope Julius III. and the election of Cardinal Caraffa to the pontifical throne. The new pontiff, who assumed the name of Paul IV. immediately demanded the protection of the French, affirmed the investiture of Naples to Henry, and used every endeavour to negotiate a strict alliance with him. This alarmed Charles, and probably hastened his resolution to resign his dominions. Before, therefore, he left the Low Countries for Spain, which he had fixed upon as the place of his retreat, he took some steps towards a peace with France. The great bar against such a pacification, on the part of France, was the treaty which Henry had just concluded with the court of Rome. An expedient was therefore proposed of terminating their hostilities by a truce for five years, during which period, without discussing their respective pretensions, each should retain what was in his possession. Still, however, Henry was embarrassed by his treaty with the Pope; but the Constable Montmorency represented to him the imprudence and injustice of sacrificing the undoubted and real interests of his country to any rash engagements into which he might have entered; and this representation, with an express stipulation that the Roman pontiff should be included in the truce, removed the doubts and scruples of the French monarch.

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As soon as Paul IV. was informed of the truce between Charles and Henry, terror and astonishment, mixed with rage and indignation, took possession of his breast; but it was necessary to conceal his emotions and feelings, as the Duke of Alva was already encamped on the frontiers of the ecclesiastical territories. Paul, therefore, in order to avert the immediate danger, affected highly to approve of the truce, and he even offered his mediation in order to bring about a permanent peace. Under this pretence, he sent Cardinal Rebiba, as his nuncio, to the court of Brussels; and his own nephew, Cardinal Caraffa, to Paris. To these were given private as well as public instructions: the latter, of course, were entirely pacific, and answering to his professions and avowed wishes; while, by the former, Cardinal Rebiba was directed to protract his negociation as long as possible; and Cardinal Caraffa was empowered to urge the King of France to renounce the treaty, or to elude its engagements, and to renew his alliance with the court of Rome. The Cardinal was by no means unacquainted with the feeble and yielding parts of Henry's character: he knew that he was entirely under the guidance and influence of his queen, the Guises, and his mistress Diana of Poitiers: to these, therefore, he applied; and having gained them by his address, they easily swayed the king, who already leaned to that side towards which they wished him to incline, his own genius, warlike and enterprising, his habits and his hopes, that the successor of Charles would be a less formidable rival, strongly urging him again to try the fate of war. The only person of consequence in the French court, who opposed the measures of the Cardinal, the influence of the Guises, the queen, and Henry's mistress, and the secret wishes of the monarch himself, was Montmorency; but his efforts and remonstrances were unavailing. The nuncio, by powers from Rome, absolved Henry from his oath, and he signed a new league with the Pope.

Broken by Henry.

Paul, as soon as he learnt the success of his intrigues, immediately threw off the mask, and no longer professed himself the friend of peace, or the mediator between the monarchs; on the contrary, he ordered the Spanish ambassador to be imprisoned; he excommunicated the Colonnas, because they were attached to the cause of Philip; and when that monarch received this noble family in his dominions, the Pope proclaimed him guilty of high treason, and to have forfeited his right to the kingdom of Naples, which he was supposed to hold of the Holy See. Against those proceedings of the sovereign pontiff, the superstitious education of Philip at first prevented him from proceeding in the manner in which a regard to his own dignity, and to the interests of his kingdom, imperiously demanded; but as the arrogance and hostility of the Pope were only augmented by the moderation and superstitious reverence which Philip displayed, that monarch at length resolved to adopt a more vigorous and determined line of conduct; and the Duke of Alva was commanded to enter the ecclesiastical territories. No sooner had the light troops of his army reached the gates of Rome, than Paul proposed a cessation of arms. To this, Alva consented; and a truce, first for 10, and then for 40 days, was concluded.

His army enters Italy, A. D. 1557.

Henry entered on the new war with great alacrity and vigour. A numerous army, well appointed, was placed under the command of the Duke of Guise, who was ordered to lose no time in crossing the Alps, and advancing into Italy. This he accordingly did, A. D. 1557. As soon as the Pope heard of the advance of this powerful army, he threw aside all disguise; breathed nothing but war and revenge; and became more arrogant than ever. He probably would not so soon have displayed his real character and wishes, had not the Duke of Alva judged it prudent to leave the papal territories, and advance to the protection of Naples, against which it was supposed the Duke of Guise would direct his more immediate and principal efforts. But the latter, though he had been eager for the war, and hoped to measure his talents against the Spanish commander, soon found that he should be able to atchieve nothing of importance. The Pope, though so indignant against Philip, had neglected to raise both the pecuniary and military aids, with which he had engaged to supply the French when they entered Italy, and the

Italian states either preserved a strict neutrality, or openly declared for the King of Spain. The Duke of Guise, however, advanced into Italy, and laid siege to Civitella, a town on the frontiers of that kingdom; but the Spaniards soon rendered it necessary for him to abandon this enterprize, by threatening Rome, to the defence of which he proceeded with a fatigued and dispirited army. Here he in vain endeavoured to bring the Duke of Alva to an engagement; but the latter perceiving the ravages which fatigue and disease were making among the French, carefully avoided a battle; and at last the Duke of Guise, mortified and disappointed, begged to be recalled.

The Spaniards invade France.

No sooner had Philip learnt that the King of France had been induced, by the intrigues of the Pope, to break the truce, than he resolved to penetrate into that kingdom, and by one vigorous effort to convince Henry that he was not to be thus treated with impunity. With this object in view, he assembled in the Netherlands a body of 50,000 men. He exerted his influence over his consort, Mary of England, so successfully, that, notwithstanding the repugnance of her subjects, she declared war against France, and sent 10,000 men to assist his projects against that country; and he gave the command of his army to Emanuel Philibert, Duke of Savoy, one of the greatest generals of that age. Philip himself fixed his head-quarters at Cambray, while the Duke, after having kept the French for a considerable time in utter ignorance of his views and destination—threatening Champagne till he succeeded in drawing all their troops in that direction—suddenly marched to the right, and invested St Quintin in Picardy. This was a place of considerable strength, but its fortifications had not recently been put in a state of repair, and a large portion of its garrison had been drawn off towards Champagne. It is probable, therefore, that it must soon have surrendered, had not Admiral Coligny taken the gallant resolution of throwing himself into it, with such troops as he could suddenly collect for that purpose. This he accomplished, notwithstanding all the circumspection and efforts of the enemy, breaking through their main body with 700 horse and 200 foot. To this hazardous step the admiral was probably incited, from the consideration that the town was within his own immediate jurisdiction. Henry was fully sensible of the importance of preserving it, as, if the enemy succeeded in taking it, the road to Paris was nearly quite open to them. He therefore hastily assembled a small body of troops, not half the number of the army which was besieging it, and gave the command of them to the Constable Montmorency.

Battle of St Quintin, 10th Aug. A. D. 1557.

This general had hitherto been distinguished, not less by his prudence and caution, than by his skill and bravery. On this occasion, however, anxious to extricate his nephew, he conducted himself with fatal rashness. At first, indeed, his attempt to relieve the town was attended with success, for, by approaching the camp of the enemy, the brother of Coligny, with 500 troops, was enabled to force his entrance into the town. Here, however, his success ended; for, in the execution of this design, Montmorency had drawn too near the entrenchments of the besiegers. The Duke of Savoy, always on the alert, took advantage of this circumstance; and, as soon as the French general began to retire, he pressed on him with superior numbers. In vain did Montmorency use his utmost endeavours to keep his men firm and in order. The Count Egmont, at the head of the Duke of Savoy's cavalry, made a furious charge, which the French could not withstand; their ranks were broken; and their men at arms, who had hitherto displayed the most cool and determined courage in the midst of the most imminent danger, sought shelter in a precipitate and disorderly flight. As soon as the horse gave way, the foot, who had depended on them for support and protection, wavered. A second charge decided their fate; they also fled in the utmost terror and confusion. Above 4000 perished in the field; and the Constable himself, after in vain endeavouring, by his example and exhortations, to reanimate his troops, and to put a stop to their flight, having received a dangerous wound, was made prisoner, along with the Dukes of Montpensier and Longueville, and the Marshal St Andre.

Consternation in France.

Such was the result of the famous battle of St Quintin, which was fought on the 10th of August 1557. The intelligence of it spread consternation and terror through France, almost to as great a degree as the battles of Cressy and Agincourt. Already it was apprehended that the enemy were approaching Paris; the inhabitants of which prepared to quit it. In this period of general dismay, the firmness and presence of mind of Henry were conspicuous, and highly beneficial. He betrayed no alarm; he refused to admit the idea of danger; on the contrary, he exerted himself to repair the loss which he had sustained, by the most prompt and vigorous measures. The Duke of Guise was instantly recalled from Italy; the assistance of the Grand Signior was solicited; the Scots were incited to invade the North of England, for the purpose of drawing off the English troops to the protection of their own territory. The ban and arrierban of the frontier provinces were called out; and, in short, every measure was taken which could operate towards the weakening or distraction of Philip's forces, or the protection of France. When we consider, however, the power of Philip, the consternation which pervaded France, and the great loss which she had sustained in the battle of St Quintin, it may well be doubted whether all these precautions and efforts would have been availing, had Philip pursued with alacrity and vigour the advantages which he had gained. But he refused to listen to the advice of the Duke of Savoy, who strongly and wisely urged, that, overlooking all inferior and intermediate objects, they should march, without the smallest delay, by the shortest route to Paris. The cautious temper of Philip, afraid of committing his forces in the heart of France, without a single place to retreat to in case of disaster, strongly objected to this plan; and he asked the opinion of his other generals. They, easily ascertaining how their monarch was inclined, recommended that the siege of St Quintin should be continued, which, it was supposed, could not now hold out many days. In this expectation they were disappointed. Coligny, fully sensible that the fate of France probably depended on his holding out till Henry had prepared sufficient means to oppose the progress of the enemy towards Paris, put forth, in a most wonderful and successful manner, all the resources of his great talents and long experience. For 17 days, he baffled the repeated assaults of the Spaniards, English, and Flemings; at length, overwhelmed by superior numbers, the town was carried by storm, and Coligny himself was taken prisoner on the breach. St Quintin was thus taken; but by this time it was no longer prudent to advance into France, and Philip became sensible that he had lost an opportunity that could never be recalled: he therefore contented himself with reducing the petty towns of Horn, Catelet, and Noyon, which, with St

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Quintin, were the sole fruits of one of the most decisive victories which had been gained in the 16th century.

The earliest account of the fatal blow which France received at the battle of St Quintin, was carried to Rome by the courier whom Henry dispatched to recal the Duke of Guise. In vain the Pope remonstrated against the departure of the French; the orders sent to the Duke were peremptory, and admitted of neither modification nor delay. Paul, therefore, was obliged to have recourse to the influence that he knew he possessed, from his character and situation, over the mind of Philip, in order to avert the danger to which he was exposed; and so well did he work on the superstition of the Spanish monarch, that, on his agreeing to renounce his league with Henry, Philip, on his part, stipulated that the Duke of Alva, the proudest man of his time, should repair in person to Rome, and after asking pardon of the Holy Father in his own name, and in that of his master, for having invaded the patrimony of the church, should receive absolution for that crime. On the very day on which the Duke of Alva made this humiliating submission to the Pope, the Duke of Guise left Rome on his return to France. Here he was received as a protecting angel, and immediately appointed lieutenant-general of the kingdom. The army which was placed under his command, was numerous and well appointed, reinforcements having arrived from Germany and Switzerland, and the new levies pouring in from different parts of France. The troops partook of their general's wish and determination to wipe off the disgrace, which their country had suffered from the defeat of St Quintin; but the Duke of Guise kept his plan a profound secret. He put his army in motion in the middle of winter, and at first menaced the frontier towns of Flanders; thus, having deceived the enemy by false marches, he suddenly laid siege to Calais. This place, for upwards of 200 years, had afforded the English an open passage into France. Notwithstanding its importance in this point of view, and that it was the only town which the English retained of their ancient and extensive territories in this kingdom, they usually withdrew almost the whole garrison at the end of autumn, and the ministers of Mary had greatly neglected the works. Some of them, indeed, were so confident as to say, that if Calais were attacked during the winter, they would undertake to defend it with their white rods. The Duke of Guise, aware of the badness of its fortifications, and the inadequacy of its garrison, suddenly invested it, drove the English from the forts which protected it, and in eight days made himself master of a place which Edward III. could not take in less time than 11 months. Henry, in order to secure this important conquest, expelled the English inhabitants, and enticed his own subjects to settle there, by granting them several important privileges and immunities.

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In the spring of 1558, the Duke of Guise advanced against Thionville, which capitulated after a siege of three weeks. In the mean time, the Marshal de Termes, who had been appointed governor of Calais, penetrated into Flanders, stormed Dunkirk, and advanced against Nieuport. While he was before this place, the Count of Egmont approached to its relief. De Termes was not only inferior in numbers to his opponent, but he was also encumbered with his spoils; he therefore resolved to retreat, but the latter circumstance rendered his retreat slow and difficult. The Count of Egmont, on the contrary, pursued, with very great activity, and overtook the French near Gravelines. De Termes finding a battle unavoidable, prepared to defend himself with great courage. For some time, notwithstanding the great disparity of the forces, victory was doubtful; till at last chance, on this, as on many other occasions, decided the fate of arms. A squadron of English vessels, which chanced to be off the coast, on hearing the cannon, entered the river Aa, and turned their guns upon the right wing of the French army, which were dispirited by this unexpected circumstance, while the Flemings were equally encouraged. The former fled in great disorder; about 2000 were killed on the field of battle; a greater number in their flight were put to death by the peasantry; and the general, with a number of officers of distinction, was taken prisoner. This disaster obliged the Duke of Guise to relinquish all his other schemes, and to hasten to the frontiers of Picardy, to oppose the progress of the enemy. About the same time, the Duke of Savoy effected a junction with the troops under the Count of Egmont. As soon as these junctions were respectively formed, Philip and Henry put themselves at the head of their armies, each commanding about 40,000 men; and being encamped at the distance of a very few leagues, an awful and decisive crisis seemed approaching. But both the monarchs were weary of war; it had answered the expectations of neither, while, for half a century, it had exhausted their respective kingdoms. Philip was anxious to visit Spain; and therefore was disposed to listen to pacific overtures. The motives and objects which inclined Henry to meet the views of Philip were more complicated. He was eager to put a stop to the progress of heresy in France. His mistress, the Duchess of Valentinois, had long regarded, with disgust and displeasure, the haughtiness of the Duke of Guise, and of his brother the Cardinal of Lorraine; and, above all things, wished to oppose their measures, and diminish their influence and popularity. This she could not expect to accomplish, so long as the Duke had an opportunity of adding to his military fame. Peace, therefore, she was bent on bringing about; and, by her persuasion, Montmorency, who was eager to regain his liberty, undertook the intricate and difficult negociation, and the Abbey of Cercamp was fixed upon as the place of congress; the conferences were afterwards removed to Chateau Cambresis, where, in 1559, a definitive treaty was signed. By this treaty, France restored to the Duke of Savoy the territories which she had taken from him in Piedmont, Savoy, and Bresse. Corsica was given up to the Genoese. Hesden, Catelet, and Noyon, were restored to the French, who were also suffered to retain Calais, Metz, Toul, and Verdun. A separate treaty was, at the same time, signed between the King of France and Elizabeth, who now sate on the throne of England, by which the former engaged, at the expiration of eight years, either to deliver up Calais, or to forfeit the sum of 500,000 crowns.

Battle of Gravelines, A. D. 1558.

Treaty of Chateau Cambresis, A. D. 1559.

In order to facilitate and hasten the conclusion of peace between Spain and France, the Constable Montmorency negociated two treaties of marriage; one between Elizabeth, the eldest daughter of Henry, and Philip; the other between Margaret, Henry's eldest sister, and the Duke of Savoy. The part which Montmorency took in all these arrangements, gave him great weight with the king; while, on the other hand, the family of the Guises, fully sensible that their influence was on the decline, and that, during a period of peace, Progress of Calvinism.

they would possess no opportunity of compensating for the diminution of this influence, by gaining military renown, and increasing their influence with the nation, arraigned the treaty in the most open and indecent manner, as dishonourable and disadvantageous to France. But Henry attended not to their complaints; he was too much occupied, either with the Duchess of Valentinois, who continued to countenance and support Montmorency, or with taking measures for the suppression of heresy. Among the most illustrious proselytes to the doctrines of Calvin, was D'Andelot, the brother of Coligny, and the nephew of the Constable. So deeply impressed was he with the truth and importance of the opinions that he had embraced, that he dared to avow them in the presence of his sovereign. He was immediately deprived of his post of general of French infantry, committed to close confinement, and restored to liberty only on submission, and through the entreaties of his uncle. So bigotted and blind was the zeal of this monarch, that he attempted a prosecution of the Duchess of Ferrara, daughter of Louis XII. who granted an asylum in her court to the literati, who were tinctured with heterodoxy; ordered the judges to cause all to be arrested as heretics, who should solicit them in favour of those who were condemned to death on account of their religious opinions; and denounced throughout the capital and the different provinces, his firm determination to root out heresy by the most severe and violent persecution.

Death of Henry.

But these plans of Henry were happily interrupted by his death. The Duke of Savoy had arrived at Paris to espouse the king's sister. Jousts and tournaments were ordered on this occasion: in these dangerous exercises Henry excelled. After having broken many lances with success, on the last day he was desirous of breaking a lance with the Count de Montgomeri. The shock was rude on each side; but the count's lance breaking against the helmet of the count, the latter attacked Henry with the stump, which entering his eye, the monarch fell senseless on the ground. He remained in a state of insensibility for eleven days, and then expired, in the 16th year of his reign, and 45th of his age. By his queen, Catharine of Medicis, he left four sons; Francis, who had been married, a few years before his father's death, to Mary queen of Scotland; Charles, Alexander, and Hercules. The names of the two last were afterwards changed to those of Henry and Francis. He also left three daughters; Elizabeth, queen of Spain; Claude, duchess of Lorraine; and Marguerette, who was first queen of Navarre, and afterwards queen of France. In some respects, the character of Henry resembled that of his father: like him, he was courteous, open, unsuspicious, and beneficent; fond of pleasure; handsome in his person, and accomplished in the martial exercises of the age; but he possessed not either the capacity or the discernment which distinguished Francis; and he was naturally so tractable and yielding, that he was almost constantly under the guidance of his favourites.

Francis II. A. D. 1559.

Character of Catherine de Medicis.

Francis II. was only 16 years of age when he ascended the throne of France. His mind and body were alike feeble, so that he was completely under the influence of those who surrounded him. Unfortunately there were about him persons not more remarkable for their talents, than from their intrigues, ambition, and vices. His mother, Catherine of Medicis, was a woman, bold; enterprising, sagacious; whose firmness and presence of mind were never awed or disconcerted by the most formidable or unexpected dangers. Her penetration was equally remarkable; and it was accompanied by a greater degree of comprehension than usually attends that quality. Thus powerful in her mental endowments; she was not less distinguished by her manners. When her interest, or particular circumstances, required it, she could be mild and insinuating; and she often appeared to gain her point, by courting those from whom she expected any favour or sacrifice, when in fact they were the dupe of her superior artifice, or actually bent before her commanding powers of mind. Her disposition was magnificent, her profusion excessive; but she was magnificent and profuse only to answer her own purposes, which, however, had frequently all the characteristics of greatness, except justice. Of the arts and sciences, even amidst the horrors of war, she was the liberal and dignified patroness; and in the patronage with which she nourished and favoured them, there was so much discrimination and knowledge, that she most effectually accomplished her object. Even to men of learning, notwithstanding her political and religious bigotry, she was a generous patroness. In short, in her might clearly be traced many of those features, both of mind and manners, which characterised the most distinguished branches of the family from which she was sprung. But these grand, and even attractive qualities, were strangely intermixed and debased by her vices and prejudices. To accomplish her views, she did not scruple to overleap the bounds of justice, truth, and humanity. She was cruel, rapacious, and deceitful; it would even seem, from some parts of her conduct, that her cruelty was so refined and disinterested (if that expression may be allowed), that it centered in itself, nor looked to any exterior object, as its own justification or excuse. In her morals, she displayed all the profligacy of her nation; her ambition was without bounds; it did not even confine itself to objects grand and comprehensive in their nature, but could, at times, feed on what was comparatively trifling and insignificant. Such a woman, even if she had not stood in the relation of mother to the young king, must have possessed great influence over his mind; and even during the life of her husband, she had been preparing herself for the exercise of power. No person was more deeply sensible of the importance of the maxim, of dividing in order to govern; and no person ever acted more systematically on that maxim.

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She soon had occasion to act on this maxim; for the weakness of Francis afforded opportunity for intrigue, and opened the way to the rule of the kingdom. The family of the Guises were perhaps next to Catherine de Medicis, most distinguished at this period for their talents and ambition: there were five brothers of them. The Duke of Guise himself; the Cardinal of Lorraine; the Duke of Aumale; the Cardinal of Guise; the Marquis of Elbeuf, and the Grand Prior: they were all men of great ambition, and who employed the greatest military and political talents, in order to acquire the highest power in the state. As they were uncles to the Queen of Scotland, and had negociated the marriage between her and Francis, they had easy access to his person, and great influence over his mind and feelings: nor were they without considerable influence with the mass of the nation. The Duke of Guise himself was regarded as the saviour of France by the deeds which he had performed, when he was recalled from Italy; and if these left any doubt respecting his military talents and skill, they were completely removed by the recollection of his defence of Metz. But he trusted for his popularity, not merely to what he had atchieved as a soldier; for to military talents he united a wonderful degree of humanity, courtesy, and liberality: at that period, when the great bulk of the people were either entirely overlooked, or considered and treated as beings of an inferior order and description, he condescended not only to notice them, but even to excite their attention and gratitude, by his marked attention to their interests, and even to their feelings and prejudices. He was not less distinguished by his zeal for religion, than for the talents and manners which we have described: and this zeal was so ardent and overpowering, that it even conquered his natural humanity of disposition and courtesy of manners. Such was the Duke of Guise himself; but his character, or at least his conduct, was considerably modified by the influence which his brother the Cardinal Lorraine possessed and exercised over him. Even in those days of high church authority, and of rigid and unbending orthodoxy, this prelate was venerated by the clergy, as the guardian of their rights and privileges, and by the Catholics as the champion of their faith. His talents were perhaps more varied than those of his brother, since he was eloquent in debate, fruitful in expedients, and versed in all the intrigues of the court; but, on the other hand, he was too readily depressed by defeat, and too easily elated by success. His personal courage was not inferior to that of the Duke's; his temper was vindictive; his morals most dissolute.

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The Constable Montmorency and his family were opposed to the family of the Guises, not more in views and interest, than in character. The constable himself was of a haughty and inflexible disposition, and would not condescend, like the Duke of Guise, to gain that influence, by the affability of his manners, which he thought ought to be the unsolicited reward, or rather consequence, of his high birth, great services, and undoubted talents. Nor was he, in other respects, better calculated for succeeding in the intrigues of a court: his notions of what was his duty, both in his public and private station, were strict, and utterly at variance with the loose and accommodating morality of the age and nation. In every respect he most conscientiously performed what his conscience dictated; and strict and severe to his own failings, he had no moderation or excuse for those of others. It may well be conceived that, with such a character, and with such high ideas of his own dignity, merits, and deserts, his temper could not be flexible, nor his address insinuating. Though he regarded the highest offices of the state as his due, yet his pride would not permit him to solicit them; and he was still further excluded from them, by his open and warm attachment to the established religion.

King
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Of the princes of the blood who next claim our attention, Antony de Bourbon, king of Navarre, was of a disposition mild, humane, and easily wrought upon. His talents were by no means of the first order; nor had he compensated for deficiency of talents, by the acquirements of culture, or by habits of application to business. Indecisive and timid, he fluctuated between the reformed and Catholic religion; fond of pleasure, he forgot his political rights, duties, and engagements, in the arms of his mistresses. Such a man was ill calculated to take the lead at the court of France; while, on the other hand, he was admirably calculated to become the instrument of intrigue and ambition, with men more highly endowed than himself. His brother, Louis, Prince of Condé, laboured under the disadvantage of an ungraceful and diminutive person; yet such were the attractions of his manners and character, that he received from the ladies of the court of France, the most flattering proofs of their affection. His courage was undoubted; and though his income was narrow, yet his magnificence and liberality were great. His talents, though not perhaps of the first order, were by no means despicable; but what distinguished him particularly, was an attachment to the reformed religion, not merely ardent and zealous, but pure and enlightened. In vain were the allurements of pleasure, and the higher and more splendid rewards of ambition, employed to entice him from his religious principles and professions: he was firm and unbending; and when they called upon him for action or sacrifice, he was always ready. To the Duke of Guise he was an open and formidable rival, not more from the similarity of their character and objects in some respects, than from the opposite religious sentiments which they respectively embraced.

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of the Admiral Coligny.

The Admiral Coligny was brave, generous, and sincere. His first and most darling wish was, to secure liberty of conscience for himself and his brethren of the reformed religion. Could he have secured this, he would willingly have withdrawn himself from public life; but while this was unattained, he regarded it as his paramount duty to stand forward, as the undisguised and enthusiastic champion of what he was convinced was the truth.

The deputies of parliament waited on Francis, soon after his ascending the throne, to express their duty and allegiance to his person: on this occasion he informed them, that he had thought proper to assign to the Duke of Guise the supreme administration of the military department, and to the Cardinal of Lorraine the supreme administration of the finances, at the same time the Constable Montmorency was dismissed from his office of master of the household to his seat at Chantilly; and the King of Navarre, with his brother the Prince of Condé, were received at court in a cold and disrespectful manner. The former was soon afterwards persuaded by Catherine de Medicis to leave Paris, and to take up his abode in Bearn, under the vain hope that he might recover his former dominions by negociation.

As soon as the King of Navarre had left Paris, the measures and plans of the Guises and Catherine began to unfold themselves. An edict was published, forbidding any person to carry fire-arms, or to wear any dress favourable to the concealment of such weapons. Another regulation was adopted, which declared that no person should hold two situations at the same time. The object of this was undoubtedly the Admiral Coligny, who immediately resigned the government of Picardy, which was given to the Marshal Brisac, notwithstanding the Prince of Condé endeavoured to obtain it. The Duke of Guise, at the same time, was appointed Master of the Household.

Progress of Calvinism.

As all these measures were preparatory to the persecution of the Protestants, it may be proper to take a retrospective view of the origin and progress of the reformed religion in France under Francis I. As has been already noticed, the new doctrine had spread greatly at court, as well as in the capital and provinces. The Christian Institutes of Calvin were dedicated to that king. His sister, the Queen of Navarre, protected his disciples, while they were persecuted by the clergy and the parliament. The spirit of the new religion was increased and invigorated, and the numbers who professed it were greatly augmented, by the massacre of Cabrieres and Merindol, and by the executions which were imprudently multiplied by Henry II. Thus, at the accession of Francis II. Calvinism had gained a firm and wide footing, and could count among its professors, several men of great talents and influence. Admiral Coligny, and his brother D'Andelot, and Cardinal Chatillon, were firm friends to a reformation; and the Prince of Condé inclined to the same side. The court, on the contrary, seemed resolved to crush the Calvinists, by the most open and violent measures. Instead of correcting the errors, which had given offence, even to conscientious Catholics, new observances still more superstitious were enjoined. Images of the Virgin, and of the saints, were placed at the corners of the streets, with tapers lighted up before them; round these, the populace assembled, singing hymns, and compelling the passengers to put money into little boxes, for the expence of the illumination. If a man did not bow to these images, and stop with marks of reverence, while the people were paying this worship, he was either knocked down, dragged to prison, or insulted. These, however, were trifling evils, to which the Protestants were exposed. Courts of ecclesiastical judicature, invested with inquisitorial powers, were erected, denominated *Chambres Ardentes,* from the severity of their punishments. To these the cognisance of heresy was entrusted. The strictest search was made to discover offenders; and as the Protestants, in order to conceal themselves, were obliged to meet by night, they were charged with committing in these assemblies the most dreadful crimes. Thus goaded on to resistance, they only waited for a fit opportunity and season to protect themselves by force of arms; and this was soon supplied them by the mixture of folly and wickedness which the court displayed. In consequence of the peace, great numbers of troops had been disbanded, without receiving what they conceived due for their services. They therefore came up to Paris, and applied to the Cardinal of Lorraine, as Minister of the Finances. He treated them with insult, unwilling or unable to satisfy their demands; and when they again importuned him, he commanded them to retire, on pain of being instantly hung upon a gallows, which he had ordered to be erected for that purpose. By this foolish and harsh behaviour, these soldiers were totally alienated from the house of Guise, to which the military talents and success, as well as the popular character of the Duke, had hitherto attached them; and they united themselves with the Protestants.

Conspiracy of Amboise.

Soon after this, the conspiracy of Amboise was formed. Of this the Prince of Condé was the invisible mover, and La Renaudie, a Protestant gentleman, the open and avowed author. The latter was a man of ancient family, but of ruined fortune: he had lost a law-suit, and been condemned to banishment for having produced fictitious titles. At Geneva and Lausanne, he imbibed the doctrines of the Reformation; and afterwards, under a feigned name, he traversed the different provinces of France, for the purpose of rousing the Protestants against the Duke of Guise. At length he appointed a general rendezvous at Nantes, where the parliament of Brittany was at that time sitting; and above 200 gentlemen of fortune and family, from various parts of the kingdom, attended the summons. Before them he laid open his plan for carrying off the Guises from Amboise, where the Court then resided; to set the Prince of Condé at the head of affairs, and to secure liberty of conscience. The day was fixed for the execution of this design, and the measures so well concerted, that its success appeared infallible. But while thousands of conspirators kept the secret, it was betrayed by an advocate, who, though a Calvinist, yet regarded the plot with horror. As soon as this information was received at court, the Duke of Guise was appointed lieutenant-general of the kingdom, with supreme power in all cases, civil and military. Renaudie, though he rather suspected, from the precautionary measures adopted by the court, that his plan was known, resolved to persevere in its execution; and several small bands of conspirators, marching only by night, succeeded in reaching, undiscovered, the gates of the castle of Amboise. Here, however, they were repulsed, and cut to pieces by the inhabitants, at the head of whom the Duke of Guise had placed himself. The Baron of Chatelnau, at the head of a considerable number of Calvinists, shut himself up in the castle of Noissy, where he was attacked by the Duke of Nemours, to whom, on condition that the lives of himself and his associates should be spared, he soon surrendered himself. As soon as Renaudie was informed of the dangerous situation of Chatelnau, he put himself at the head of a few men, as desperate as himself, with the intention of either rescuing him, or perishing in the attempt. On the road he was met by 200 cavalry of the opposite party. A most desperate action took place; but Renaudie's companions being overcome by superior numbers, he rode up to the commander of the cavalry, and thrusting a poinard through his vizor, laid him dead upon the spot. He himself was afterwards shot, and died fighting desperately to the last. His body was publicly exposed on a gibbet, and a label affixed to it, with the inscription, *Chief of the Rebels.*

The fate of Renaudie produced not the effects which the court expected. On the contrary, the Protestant party increased in numbers, and displayed additional zeal and activity. Still the Court adhered to their measures of rigour and duplicity. The Baron of Chatelnau, notwithstanding the assurances of safety which he had received, was sacrificed to the implacable enmity of the princes of Lorraine. Every temptation was held out to him, to name the Prince of Condé as his accomplice; but though a declaration to that effect had been extorted from his companions, he firmly refuted the aspersion, and to the last moment of his life, proclaimed the innocence of the Prince of Condé.

This prince now thought himself called upon openly to vindicate his honour, which he did in the presence of the king, offering to maintain it, in single combat, against his accuser. It could not possibly be mistaken that he pointed at the Duke of Guise; but the Duke eluded the challenge, warmly praising the conduct of the prince, and offering to be his second against any antagonist. In private, however, he strongly urged the king to secure a chief, who was so formidable, on account of his birth, talents, and enterprize. Francis, easily led, and sensible of the danger to which he might be exposed from the intrigues of the prince, seemed disposed to have listened to this advice; but at this period, in consequence of the death of the Chancellor Olivier, and the succession of Michael De l'Hospital to that office, the power of the Guises suffered a decline; for the new chancellor, being a man of cool temper, great abilities, and a friend rather to his king and country than to any of the parties which then endeavoured to gain an ascendency over them, pointed out, in the strongest manner, to the queen-mother, the danger of the family of the Guises acquiring a permanent ascendency, and advised her to follow that temporising system of policy, to which she was so naturally inclined by her disposition, and so happily adapted by her habits and talents. In consequence of this advice, Catherine lent her support secretly to the Prince of Condé and the Protestants.

General assembly at Fontainebleau.

At this time, the internal state of the kingdom was so overcast with danger, that it was deemed necessary to hold a general assembly at Fontainebleau, to deliberate on the exigencies of the state. At this assembly, the Admiral Coligny presented to the king a petition from the Calvinists, demanding the public exercise of their religion, and that their public meetings might no longer be imputed to them as a crime; adding, that although no name was affixed to it, yet, whenever his majesty would signify his pleasure, it would be signed by 150,000 persons. Montluc, Bishop of Valence, and Marilla, Archbishop of Vienne, spoke with energy against the abuses which occasioned so many troubles and disorders; exposed the vices of the court of Rome—the ignorance and corruption of the French clergy—the avarice of the Italians, who, without residing in the kingdom, possessed one-third of the benefices—the injustice of the persecution, which confounded the innocent with the guilty—and concluded, by stating it as their firm opinion, that the public calamities arose from the errors which had crept into religion, and from the vicious conduct of those who were its ministers. At the same time, while they, in this bold and liberal manner, advocated the cause of truth, and denounced the vicious and corrupt, they condemned the *seditious religionists*, and insisted on the necessity of repressing and curbing them, marking the distinction, however, between those who made religion a pretext for disturbing the state, and such as adhered to their errors from a principle of sincerity: the latter they thought it was wrong to treat as criminals. They even went farther, and pointed out, in clear and strong terms, the dangers which might arise from persecution. Opinions in themselves weak, thus acquired, in the view of the multitude, strength and importance. A curiosity to know, and often a desire to embrace them, was excited, when people saw them maintained in the midst of the flames, by men of estimable character and irreproachable morals. After again insisting on the necessity of a reformation, they concluded with proposing a national synod, if the Pope should refuse to convoke a general council, with a prohibition of exerting the severity of the law except against real crimes.

Coligny afterwards rose again, and in plain and manly language advocated the cause which he had conscientiously embraced. He then adverted to the guard which had recently been placed around the king, reminding his majesty, that in the affection and loyalty of his subjects he would always find the most faithful and brave defence; that nothing could be more prejudicial to his real interests, as well as to the interests of the nation at large, than that he should either be dreaded by his subjects, or the object of dread to them. He concluded, by repeating his opinion, that the king's guard should be discharged. The States-general assembled, and methods contrived to root out, not only speculative, but practical errors from the church. If these things were done sincerely and effectually, the king would regain the affections of his subjects, the nation would be peaceable and happy, and real religion would flourish and influence the conduct of all. This speech of the admiral, so much in character, called up the Duke of Guise, who purposely misrepresented the advice and wishes of Coligny, declaring, with much warmth, that no council should force or influence him to change his religion. The Cardinal of Lorraine followed and supported his brother, denying the imputations which Coligny had cast on the opinions and practices of the church, strongly insisting on the necessity and sacred obligation of extirpating error by the secular power, and branding as seditious the advice which Coligny had given. The opinions of the Guises would probably have been carried into full effect, had not Catherine of Medicis considered it as her best policy to check their violence, and to use her influence with the king to countenance, at least, the advice of Coligny and his party. Francis therefore declared his intention of convoking the states in the ensuing December, and thus breathing time was given to the Protestants.

It was evidently their policy to keep well with Catherine of Medicis; and this they could only effect by not alarming either her ambition or her religious prejudices; but unfortunately they conducted themselves in such a manner as to excite her hatred, and to induce her again to unite herself with the Guises: For the King of Navarre and the Prince of Conde concerted measures to deprive the Guises of their power and influence before the states assembled; and even laid a plan for surprising the city of Lyons. This plan reached Catherine, who, regarding it as proceeding from a spirit which looked farther than the mere overthrow of the Guises, took the alarm, and, by the interception of some letters, completely defeated the execution of it.

Danger of the King of Navarre and the Prince of Condé.

In the mean time, the period for the assembly of the states drew near. It had been originally appointed to be held at Meaux, but it was afterwards transferred to Orleans. Hither the king, now in a very dangerous state of health, proceeded, with a guard of 1000 cavalry. The King of Navarre, and his brother the Prince of Condé, were invited to attend, with the strongest assurances, not only that they should be safe, but that such measures would be adopted at this assembly as would satisfy them, and please the Protestants. At first they were suspicious of the machinations of the Guises, but at last they resolved to obey the summons. In the course of their journey, they were darkly and mysteriously informed of some danger that threatened them; but justly concluding, that if they discovered suspicion or alarm, or if they returned instead of proceeding, they might probably expose themselves to still greater risk, they resolved to go on to Orleans. Indeed, they beheld before, behind, and on all sides of them, parties of men stationed there under various pretexts, but whom they had just reason to apprehend were instructed to intercept their retreat or flight.

When they arrived at Orleans, the king at first treated them with great coldness and indifference; but this behaviour was soon changed, and succeeded by the most violent reproaches, and such accusations as left them no doubt that they had acted imprudently in attending the assembly. Between the Duke of Guise and the Cardinal of Lorraine the king was seated; around him were the captains of his guards. On the Prince of Condé he fixed a look as full of determination and meaning as he could well call up, and accused him of having attempted to seize on the principal cities in France, and even of having plotted to take away his life and that of his brother's. This accusation, so unexpected, and brought forward at a time and in a place which bespoke a determination to throw aside all regard to justice and innocence, by no means daunted the intrepid Condé. He protested that he was guiltless of the crime laid to his charge, and he offered to prove his innocence. To this offer Francis replied, that it would be necessary to proceed by the usual modes of justice. On this, the King of Navarre was conducted to an adjoining apartment, where, however, he was allowed the liberty of conversation; but the Prince of Condé was strictly confined, and with such precautions plainly indicated that it was resolved to take away his life. The Protestants immediately took the alarm; but the Guises were afraid to proceed to extremities too suddenly; and the admiral, though he remained at Orleans, was unmolested. His brother D'Andilot, some time before, suspicious of the treachery of the Guises, had withdrawn into Brittany.

The Prince of Condé condemned;

The chancellor and five judges were appointed to interrogate the Prince of Condé in prison; but he refused to answer to their questions, and boldly demanded to be tried in the most public manner. This, he said, he claimed as due to his dignity and rank, not less than to his innocence. Catherine of Medicis, by whose advice, or at least with whose concurrence, the king had taken these steps, and who, at first, with her characteristic duplicity, affected to deplore the violence which she herself had consented to, soon discovered the error she had committed, in uniting herself too closely with the Princes of Lorraine, and in destroying that balance of parties most favourable to the success of her own intrigues, and to her own views and interest: But she had gone too far to recede; and the fate of Condé seemed inevitable, when he was preserved by the death of the king. Francis, on his return from the chace, was seized with a violent pain in his ear; in a short time an imposthume was formed, and the surgeons declared that nothing could save him. The Duke of Guise and the Cardinal of Lorraine thus beholding their power, in all probability, drawing to a conclusion, while the very same cause must preserve the life of their rival, hurried on the process in a most shameful and indecent manner, neglecting even the forms of justice. As the judges were entirely under their influence, they found him guilty without the slightest hesitation; and he was condemned to have his head struck off on a scaffold before the apartment of the king.

Before, however, the execution could take place, it was indispensably necessary that the signature of the chancellor should be put to the order for that purpose. De l'Hospital was a man always averse to violent measures; and in this case, as the king's death was expected every hour, he was reasonably afraid lest he should be called to account if he lent the authority of his official character to the execution of such an unjust and illegal sentence. The Guises in vain appealed to Francis; he was now too weak to understand what they wanted; and even while they were urging him to issue his orders to the chancellor to affix his signature to the warrant for their rival's death, he breathed his last. Thus was the Prince of Condé snatched from the very jaws of destruction. The character of Francis was not marked by any strong or discriminating features; nor could it indeed be expected, when we reflect on his extreme youth—on the manner in which that youth had been spent—and on the talents and intrigues of those by whom he was constantly surrounded, and who, however they might differ among themselves, took especial care that the king should never think or act for himself. His death opened up a new scene for intrigue and ambition; and so eagerly were Catherine and the Princes of Lorraine engaged in securing or extending their influence, that the funeral of the king was attended only by those who had been his governors, and by the Bishop of Senlis.

saved by the death of Francis.

Charles IX. A.D. 156

Francis II. was succeeded by his brother Charles IX. then only ten years of age. The extreme youth of her son afforded Catherine an ample field for her powers of ambition and intrigue. She was resolved not to commit the management of Charles to any person, but to wield herself the whole machine of government; at the same time she was fully aware, that her power would not be secure or permanent, unless she acted on her favourite maxim, *divide and govern*. After, therefore, she had obtained for herself the appointment of guardian to her son, she directed her thoughts to the leaders of the principal parties in the state. The King of Navarre was named lieutenant-general of the kingdom; the sentence against Condé was annulled, and he was pronounced innocent; the constable Montmorency was recalled to court; and thus the princes of Lorraine, though they still enjoyed high offices and great power, found a counterpoise to the weight of their influence. To this league, Catherine gave the name of the Triumvirate. In a short time, however, she began to dread the effects of that which she had taken such pains to accomplish; and her endeavours were now directed to weaken the force, and divide the interests of the three great parties. With this view, she tempted the King of Navarre, by the charms of one of her maids of honour, to renounce his claim to the regency as first prince of the blood; and she deceived Coligny, by the protection she afforded to the doctrines and followers of Calvin. This conduct alarmed or disgusted the other branches of the Triumvirate, who, in their turn, used their efforts to weaken and divide the party of the Queen. The King of Navarre, always vacillating and inconstant, was soon drawn over, by the vain promise of receiving the island of Sardinia as a compensation for his kingdom of Navarre.

Conduct of Catherine de Medicis.

Meeting of the States-general.

In the mean time, the States-general again met, in 1560, at Orleans; but their labours were of no effect in tranquillising the nation. At this assembly, the third estate and the nobility concurred in demanding the reform of the clergy, to whose ignorance and vice they ascribed not only the rapid spread of Calvinism, but all the evils which afflicted the nation. The clergy, however, as might naturally be expected, proclaimed their own innocence, and ascribed the growth of Calvinism, and the distracted state of the country, to the love of innovation. Catherine, always attentive to her own schemes, having at this time professed her desire that the Calvinists should be protected, and even displayed some symptoms of favouring their doctrine, proposed the expedient of a conference between them and the Catholics. The cardinal of Lorraine, filled with vanity, and not doubting that at this conference he should for ever silence the supporters of the new doctrine, willingly consented to this scheme. In 1561, therefore, the famous conference of Paissi was held, which terminated, as might have been anticipated, in confirming each party in his peculiar tenets, and in increasing the persecuting spirit of the Catholics, and the zeal of the Calvinists. The cardinal of Lorraine, and Theodore Beza, were the principal disputants. Lainez, the second general of the order of the Jesuits, and the principal author of their regulations, was sent by Pope Pius IV. to attend this conference; but the violence and persecuting spirit which he manifested in his harangues, alarmed and displeased Catherine, who, at this time, deemed it her policy to keep her bigotry under the management of her ambition. In order, how-

Conference of Paissi, A.D. 15

ever, that her orthodoxy might not be suspected, she agreed to the establishment of a college of Jesuits in France.

In 1562, Catherine, in furtherance of her plans of uniting the Protestants on her side against the Duke of Guise, caused an edict to be issued, by which liberty of conscience was granted to them, on condition that they should hold their religious assemblies only in the suburbs, or in the country, and not in any of the cities or towns of the kingdom. Scarcely was this edict published, before great numbers, whom the fear of persecution had hitherto restrained, now openly professed the reformed religion; the religious assemblies of the Calvinists were crowded; the Catholics were insulted, and they in their turn insulted the Protestants. At this critical juncture, it happened that the Duke of Guise, on his journey to Paris, halted at Viessy, a small town in Champagne, where his attendants insulted a congregation of Protestants, who were assembled at their devotions in a barn. The Protestants being more numerous, and knowing that the law was on their side, repelled the assailants with stones. The Duke, as soon as he learnt what was going on, hastened to the spot, and, in his attempt to quell the dispute, he was wounded in the face. His servants, enraged at this, drew their swords, and killed and wounded above 250 of the Protestants. As soon as the tumult was over, the Duke of Guise severely reprimanded the magistrate of the place, for permitting the assemblies of the Protestants to be held there; and when he pleaded the royal edict in their favour, as his authority and justification, the Duke laying his hand on his sword, angrily replied, "This shall cut the bond of that edict, however strong it may be."

assacre of
iessy,
D. 1562.

The intelligence of the massacre of Viessy, greatly exaggerated, and the report of the Duke's speech, soon reached the Prince of Condé, who demanded instant satisfaction from the court. Catherine was puzzled how to act; but at length she resolved to promise him the satisfaction he required, well knowing that her promise would be rendered futile by the remonstrances and opposition of the King of Navarre and the Triumvirate. So it happened; they openly refused to obey her commands; and they were strengthened in their refusal, by the arrival of the Duke of Guise at Paris with 1200 cavalry. Catherine now became seriously alarmed for her own safety, and for the continuance of her power over the King. She therefore made a forcible appeal to the Prince of Condé, exhorting him to rescue his sovereign from captivity, and thus affording him the pretence he wished for to arm his associates. The Triumvirate proclaiming to the nation, that they wished to rescue him from the Calvinists, seized his person, and conducted him, and his indignant mother, who vainly lamented the consequences of her own machinations, first to Melun, and afterwards to the capital.

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civil

Such was the beginning of the civil wars, that desolated and weakened France for so long a period of time. The Prince of Condé having consulted with the admiral, put himself at the head of 2000 cavalry, pushed forward, and made himself master of Orleans. Here having established his head-quarters, it became necessary for him to strengthen his cause by every means in his power. His first object was to quiet the suspicions of the Catholics in France as much as possible. With this view, he declared that he had taken up arms, to relieve the King and his mother from captivity. He next dispatched messengers into Germany, to solicit the aid of his Protestant brethren; and he gave up Havre to Elizabeth, Queen of England, in order to obtain her assistance. The chancellor De l'Hospital made an attempt to prevent the dreadful evils of a civil war; but this failing, both parties prepared for hostilities. The Catholic army was first in a condition to take the field, and after plundering Blois, Tours, and Bourges, it sat down before Rouen. This place was occupied by a garrison under the command of that Montgomery, who had been the innocent cause of the death of Henry II. In consequence of his having been pursued by the implacable resentment of Catherine, he had taken refuge in England, where he had embraced the reformed religion, and from which country he had returned as soon as the civil war commenced. His courage naturally great, and his talents and experience by no means of an ordinary description, were called into full action on this occasion; and the inhabitants, encouraged by his example, refused all offers of capitulation. At last, after a most obstinate defence, the city was taken by assault. Montgomery escaped with a few companions in a boat, but the inhabitants suffered every species of outrage which an enraged soldiery could inflict. In the course of the siege, the King of Navarre received a wound, which soon afterwards caused his death.

The Prince of Condé hitherto had not been able to act offensively; but having now been joined by 12,000 men from Germany, he attempted to surprise Paris; but not succeeding, he retired into Normandy. In his retreat, he was pursued by the Catholic army, which came up to him at Draix. Here, in 1563, the first civil battle took place, and it was fought with the rancorous obstinacy which always fatally distinguishes civil wars. In the beginning of the engagement, nothing could withstand the impetuous charge of the Protestants; and the Constable Montmorency having been wounded, was taken prisoner. But the Duke of Guise, by his calm and circumspect courage, more than compensated for these disasters. The Protestants, in their eagerness of pursuit, had weakened their line: on it the Duke fell suddenly, and with great force. The Prince of Condé, being dismounted and surrounded, was obliged to surrender to the second son of the constable. The command now devolved on Coligny, and it required all his talents, and the animating example of his courage, to rally his troops, and conduct them, before a superior force, towards Orleans.

Battle of
Draix,
A. D. 1563.

Although the queen-mother, in consequence of this victory, was fully sensible that the influence of the Princes of Lorraine was become much more formidable than it had ever been before, yet the military talents of the Duke had been so conspicuously displayed in atchieving it, that she found herself under the necessity of conferring on him the chief command of the army, with which, indeed, he had been already invested by the tumultuous acclamations of the soldiers. The capture of Orleans was the next object at which the Duke aimed. Coligny, having gone into Normandy in order to receive the supplies which he expected from England, had left in that city his brother D'Andelot with 2000 of his troops, with instructions to defend it to the last extremity. These orders, the Duke, from the tried valour of D'Andelot, had every reason to conclude would be obeyed in their fullest sense; but he was rather urged on than intimidated by this consideration. In less than a month, he had made himself master of the bridge across the Loire, and of the suburbs; and the fate of Orleans seemed at hand, when the duke was assassinated by a gentleman of the name of Poltrot. In his last moments, he exhorted Catherine to extinguish the civil war, which was just begun: he lamented the

Assassination of the
Duke of
Guise.

massacre of Viessy as the cause of it, but declared, that, with respect to it, he was completely innocent; and he recommended to his eldest son, Henry, an inviolable attachment to his sovereign.

Treaty with the Protestants.

The command of the army before Orleans was given, on the death of the Duke, to the Marshal Brisac; but Catherine, at the same time, discovering a wish for peace, the terms were soon settled by the constable and the Prince of Condé. By this treaty, the free exercise of their religion was granted to the Protestants, on condition that they laid down their arms, gave up the places which they occupied, and renounced their alliance with England.

A. D. 1564.

In 1564, Catherine having obliged the parliament of Paris to declare the regal authority at an end, though Charles had not yet completed his 14th year, made a progress through France, along with him, under the pretence of ascertaining its state and resources. At Bayonne, they were met by the Queen of Spain, sister to Charles, and by the Duke of Alva. A long and mysterious conference took place, which, it is said, was held at the solicitation of the Pope. Every thing was conducted in the most private manner; but when the Protestants considered the character of the Duke of Alva, and of his master the King of Spain, both avowed and most bitter enemies to their religion, and the duplicity of Catherine, they were filled with alarm and suspicion.

Apprehension of the Protestants.

Their apprehension of impending danger was further increased, by the conduct of the Catholic magistrates towards them, who, in direct and open violation of the edict which had recently passed, securing them the free exercise of their religion, threw every obstacle in the way of their assemblies, and rather encouraged than restrained the populace in insulting them. In this state of apprehension, they had recourse to the Prince of Condé; but he, either from prudential motives, or because he still hoped to be appointed lieutenant-general of the kingdom, strongly advised them to suffer quietly. This they did for nearly two years, till the prince, perceiving that the court was not sincere in its conduct towards him, and that it was only waiting for a fit opportunity to crush effectually and for ever the Protestants, determined to have again recourse to arms. Catherine had hoped that her measures were so well concerted, and at the same time kept so secret, that the Protestants would not proceed to open violence, at least till she was fully prepared to resist and overwhelm them. She was therefore surprised and astonished, when she learnt that the ruin which she had plotted against them, was likely to fall on herself and on her party. The king, Catherine, and the ministers, were at this time at Monceau, when she was informed that the Prince of Condé was preparing to march against that place, for the purpose of seizing the person of Charles. She therefore hastily retired with him into Meaux, and afterwards to Paris. On his way from Meaux to the capital, he was surrounded and protected by a body of 6000 Swiss troops. Scarcely had he proceeded two leagues, before the Prince of Condé appeared in sight at the head of 200 cavalry. The Constable Montmorency, upon this, sent the monarch forward by private roads to Paris, under the escort of a body of cavalry, and with the remainder of the troops succeeded in repulsing the Prince. Thus was a second civil war begun.

Second civil war.

Condé being thus deceived in his hope of seizing the king, proceeded to St Denis, which he occupied, and thus cut off the supplies of the capital. Upon this, the constable, notwithstanding he was anxious cautiously to avoid a battle, yet being urged by the tumultuous importunities of the Parisians to free them from the inconveniences of a siege, marched forth at the head of nearly 20,000 men. The Protestants, though their numbers did not exceed 3000, by no means declined a battle. For upwards of three hours, they resisted most courageously such superior numbers, till at length they were compelled to give way; but this victory was dearly bought by the Catholics, at the expence of the death of Montmorency, who, even after he was wounded, and at the advanced age of 75, fought with all the ardour of a young man.

Battle of St Denis, A. D. 1567.

Condé was not dismayed by this defeat; but, having collected his dispersed troops, and having received a strong reinforcement of German Protestants, he appeared again in the field, at the head of a formidable army. He even again blocked up the capital, and attempted to possess himself of the suburbs; but being foiled in this, he traversed the greatest part of the kingdom, and at last laid siege to Chartres, a place of much importance. While he was before this city, terms of accommodation were proposed by the court, and accepted by Condé. They were similar to those formerly granted, and produced rather a suspension of hostilities than a renewal of peace.

Character of Charles.

The character of Charles now began to unfold itself; and it was such as might have been anticipated from the principles in which he had been brought up,—the maxims which his mother had inculcated,—the example which she had set before them,—and the circumstances of the kingdom, both political and religious, in which he had passed his youth. He was a thorough adept in the art of dissimulation, which indeed he carried to such an extent, that though his bigotry and hatred of the Protestants was extreme, he could conceal even those feelings, when it was necessary so to do, for the accomplishment of his wishes or purposes. He was eager after glory; but even this eagerness bore the stamp of his bigotry; for, instead of looking beyond his own kingdom for the acquisition of it, he contented himself with that glory which could be derived from overwhelming the Protestants: and, unlike a man whose love of glory excludes every thing that is mean or dishonourable, he often preferred the gratification of his bigotted and persecuting spirit, to a fair and open competition with the Protestants in the field of battle. On the death of Montmorency, being importuned to bestow the office of constable on his brother Henry, he replied, "I want no person to carry my sword; I will carry it myself:" by these words not only displaying his own character, but intimating that he thought the office of constable conferred too much power on the person who bore it. The treaty which had been concluded, was not likely to be of long duration: in fact, neither party were sincere. The Prince of Condé had acceded to it, because he was unable to satisfy the demands of his German auxiliaries; and the court party, because they always preferred intrigue and dissimulation to open hostility.

Plot [illegible] Condé [illegible] Colig

In less than six months after it was concluded, Catherine laid a plot for seizing the Prince of Condé and Admiral Coligny. They received intelligence of their danger, fled to Rochelle, and summoned their partisans to their assistance. To this place the Protestants resorted in great numbers; among the rest, Jane, Queen of Navarre, with her infant son, afterwards Henry IV. In vain did the Chancellor De l'Hospital endeavour to avert a civil war; his advice and remonstrances were neglected; he was dismissed from his office; and the seals were given to the Bishop of

Orleans, a most bigotted Catholic. The Duke of Anjou, brother to the king, though little more than 16 years of age, was appointed lieutenant-general of the kingdom; and along with him was sent to the army the Marshal Tavannes, a man of great military experience and reputation. In the mean time, the Prince of Condé was not idle. Having received money and ammunition, he marched to Soissons, in order to meet the reinforcements which he expected from Germany.

Battle of arnac, . D. 1569.

As it was of the utmost consequence that the prince should be attacked before he was reinforced, the Catholic army rapidly advanced for this purpose, and succeeded in overtaking them on the banks of the Charenti, at Jarnac, a small village in the province of Angoumois. The Protestants were surprised, and they were inferior in numbers; yet, for upwards of seven hours, they fought with the utmost steadiness and bravery. The Prince of Condé's arm was in a scarf, in consequence of a wound received in a former action; and just as the battle was beginning, his leg was accidentally broken by the horse of his brother-in-law: notwithstanding all this, he betrayed no symptoms of pain or uneasiness, but, retaining his wonted dignity and presence of mind, he thus addressed those who immediately surrounded him: "Nobility of France,—know that the Prince of Condé, with an arm in a scarf, and a leg broken, fears not to give battle, since you attend him." At last, after the Prince himself, Coligny, D'Andelot, Montgomery, and Rochefoucault, had vied with each other in displays of skill and valour, the Protestants were compelled to yield. The Prince alone, incapable of flight, covered with wounds, and exhausted with fatigue, was surrounded and taken prisoner, and afterwards killed in cold blood by a captain of the Duke of Anjou's guard.

The Protestants, though defeated, were not dispirited, and the resources of the fertile mind of Coligny were called into immediate and full action on this occasion. He collected the scattered troops, took such measures for their security and protection as he deemed most proper and necessary, and succeeded in reaching Poitou. Here he was joined by the Queen of Navarre, with such troops as he could collect; and her young son Henry, presented to the army, and received with universal acclamations, was declared general, along with his cousin the young Prince of Condé.

Coligny, who still exercised the actual command and direction of the forces, being strengthened by some German auxiliaries, again took the field, obliged the Duke of Anjou to retreat, and invested Poitiers. Into this place, the young Duke of Guise, recollecting the glory which his father had acquired by his defence of Metz, had thrown himself, and animated the garrison, by his valour and conduct, to a most resolute defence. In the mean time, the Duke of Anjou advanced with a powerful army; and Coligny thus threatened, and finding that there was no chance of reducing Poitiers, abandoned the siege. He would have also carefully avoided a battle; but as he was incapable of satisfying the demands of his German auxiliaries, he was under the necessity of fighting while they remained with him, lest on their departure he might be attacked at a still greater disadvantage. Such was the cause which led to the battle of Monteoncour. The obstinacy of the combatants was great; but the numbers of the Catholics, and the superior discipline of the Swiss, prevailed. The admiral was wounded in the beginning of the action; but his wound was totally disregarded, and he continued fighting with the utmost gallantry, till he was convinced that his efforts were no longer of any advantage. He then, at the head of only 300 horse, accompanied by the young King of Navarre and the Prince of Condé, reached Parthenai, about six leagues from the field of battle. Such was the rise of the reputation of the second Duke of Guise; for to his obstinate and skilful defence of Poitiers, the disasters of the Protestants may justly be ascribed.

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As the Protestants had lost nearly 10,000 men in the battle of Monteoncour, the court of France and the Catholics fondly imagined that their power was finally and completely broken; what then was their surprise to learn, that Coligny, undaunted by so signal a defeat, had suddenly appeared in another quarter of the kingdom; had assembled a formidable army, accomplished an incredible march, and was ready to besiege Paris. The state of the finances was such, that the king found it impossible to raise and support an army sufficiently powerful to overcome the persevering and indefatigable Coligny: he was therefore obliged A. D. 1570, notwithstanding his violent animosity against the Protestants, to enter into a negociation with them at St Germain en Laye. By this treaty, the edicts in their favour were confirmed; a pardon was granted for all their past offences; they were declared capable of all offices, both civil and military; they were restored to all their employments and dignities; and Rochelle, La Charite, Montauban, and Cogniac, were ceded to them for two years, as places of refuge, and pledges for their security. The first of these cities kept the sea open for receiving succours from England; the second preserved the passage of the Loire; the third commanded the frontiers of Languedoc; and the fourth opened a passage into Angoumois, where the Protestants possessed greater strength than in any other province.

Treaty of St Germain en Laye, A. D. 1570.

Intrigues of Catherine and the King.

Both Catherine and her son, being now convinced that the destruction of the Protestants could be effected only by intrigue, resolved to exert all the powers of their minds to carry it on in such a manner as might most effectually deceive the proposed victims of it. With this view they pretended to be averse to the measures of the Guises as unfriendly to the Protestants; and even treated them with coolness and indifference. The king proposed to give his sister Margaret in marriage to Henry of Navarre, as a further proof of his change of sentiments, and further security to the Protestants. This proposal was readily accepted; and so deeply laid were the plans of Catherine and her son, that even the Admiral Coligny, notwithstanding a letter which he received, putting him in mind of the faithless characters of them both, was deceived by their specious conduct and professions.

Catherine, having so often been foiled in her attempts to crush the Protestants, both by open and secret measures, was resolved that her present plan should not be frustrated by precipitation: for two years she permitted France to enjoy the blessings of tranquillity; and during the whole of this period, the conduct both of herself and of the king, continued such, as effectually lulled the suspicions of the most timid and apprehensive Protestants. At last having succeeded in persuading the admiral to come to Paris, along with the most considerable men of the Protestant party, in order to assist at the celebration of the marriage of Margaret and Henry, Catherine and the king resolved to hasten the catastrophe.

The marriage was celebrated on the 17th of August

1572; and, on the 22d of that month, Coligny was wounded by a shot from a window, as he was going to his house. Upon learning this, the king paid him a visit, promised to find out and punish the assassin, and to all appearance was filled with indignation and sorrow for the accident. Two days after this, on the 24th of August, the massacre of St Bartholomew took place. When the king gave his directions respecting it, he added, with his customary oaths, "Since it is to be done, take care that no one escapes to reproach me." The direction of the massacre was entrusted more especially to the Duke of Guise; and the signal for its commencement was to be given by striking the great bell of the palace. Coligny, regular in his habits, and still weak with his wounds, had retired to rest on the eve of St Bartholomew very early; but he was roused by the noise of the assassins, who had surrounded his house. A German, of the name of Besme, entered his chamber; and the admiral, suspicious of his designs, prepared to meet his fate with calm and firm resignation. Scarcely had he uttered the words, "Young man, respect these grey hairs, nor stain them with blood," when the German plunged his sword into his bosom, and afterwards threw the corpse into the court. The Duke of Guise beheld it in silence; but Henry, Count of Angouleme, natural brother to the king, spurned it with his foot, exclaiming, "Courage, my friends; we have begun well, let us also finish well."

Massacre of St Bartholomew, A. D. 1572.

For five days did the massacre continue. The Catholic citizens, who had been secretly prepared, by their leaders, for such a scene, zealously seconded the execution of the soldiery, and imbued their hands, without remorse, in the blood of their neighbours, their companions, and even their nearest relations. Among the most illustrious victims, beside Coligny, were the Count de Rochefoucault and Teligni, who had married the daughter of the admiral. The Count de Montgomery, and the Vidame of Chartres, with near a hundred others, who lodged on the south of the Seine, escaped on horseback, half naked; but they were pursued and overtaken by the Duke of Guise, who cut in pieces nearly the whole of them.

The young King of Navarre and the Prince of Condé, exempted from the general destruction, were brought before Charles, and commanded to abjure their religion. The King of Navarre consented; but the Prince hesitating, Charles, in a transport of rage, exclaimed, "Death, mass, or the bastile!" The violence of this threat intimidated the Prince; and, recanting his heresy, he received absolution from the Cardinal of Bourbon.

The Prince of Condé recants.

During the greater part of the massacre, Charles posted himself at one of the windows of his palace, from which he not only saw and encouraged the assassins, by frequently calling out, "Kill, kill!" but even repeatedly fired upon the miserable fugitives.

Massacre in the Provinces.

The same barbarous orders were sent to all the provinces of the kingdom; and they were faithfully obeyed in Lyons, Orleans, Rouen, Bourges, Angers, and Toulouse. In Provence, Dauphiné, and some other parts, the Protestants were protected. The Viscount Orthes, who commanded in Bayonne, in reply to the order which he received, wrote back to the king, that Bayonne contained loyal citizens and brave soldiers, but that among them he was not able to find one executioner. The Bishop of Liseux, on this occasion, conducted himself in a manner becoming the religion of which he was the minister; for when the commandant of that place communicated to him the orders of the court, he answered, "You must not execute them; those whom you are commanded to destroy are my flock; it is true they have gone astray, but I shall use my endeavours to bring them back to the right fold. The gospel does not say, that the shepherd should spill the blood of his flock; on the contrary, I read in it, that I ought, if necessary, to spill my blood for them." These instances of humanity were, however, few; and it is supposed that, throughout France, 25,000 Protestants perished, and in Paris alone 10,000.

As a justification of this dreadful and unparalleled massacre, Charles pretended, that the Protestants had formed a conspiracy to seize his person; and that, in his own defence, he had been under the necessity of giving orders for its execution. But the real motive and object were by no means thus concealed; nay, they were even displayed to public notice, by the proceedings of the parliament and the court. The former ordered an annual procession to celebrate the deliverance of the kingdom; and the latter had a medal struck, with a legend, intimating, in express terms, that piety had armed justice on this occasion. Still more unequivocally were the real causes of the massacre of St Bartholomew displayed by the feelings with which the intelligence of it was received at Rome and in Spain. In both, public rejoicings were held, and solemn thanks were returned to God for its success, under the name of the "triumph of the church militant." Among the Protestants, it excited the most deep and penetrating horror, and no where to a greater degree than in England. Fenelon, the French ambassador at the court of St James, gives the following striking picture of his first audience after the massacre was known: "A gloomy sorrow sate on every face; silence, as in the dead of night, reigned through all the chambers of the royal apartments; the ladies and the courtiers, clad in deep mourning, were ranged on every side; and as I passed by them, in my approach to the queen, not one bestowed on me a favourable look, or made the least return to my salutations."

Joy manifested by the court, the Pope, and the King of Spain.

Effect produced St James.

The effect of the massacre on the Protestants was directly the reverse of what the king expected; but exactly such as a knowledge of human nature, and of religious zeal and enthusiasm, would have anticipated. Calvinism, instead of being destroyed, became more formidable by despair; and a thirst for revenge, united to an ardent spirit of civil and religious liberty. A fourth civil war was kindled. The Protestants assembled in large bodies, and took refuge in the strong places which belonged to their party. In these, now fatally convinced that their only alternative was open rebellion—if rebellion it might be called—or persecution, they resolved to defend themselves to the last extremity. At their head appeared the King of Navarre and the Prince of Condé, both of whom abjured a religion which they had been compelled to profess. Rochelle made a desperate defence against the Duke of Anjou, who lost almost all his army before it. The siege continued eight months, during which time the citizens repelled nine general, and twenty particular attacks, and at length obliged the Duke to grant them an advantageous peace. The town of Sancerre was defended with equal bravery for upwards of seven months; nor did the inhabitants surrender till they had obtained the promise of liberty of conscience. About this time, the Duke of Anjou was elected King of Poland; and the miseries of France daily increasing, Charles embraced the pretence afforded by the elevation of his brother to conclude a treaty with the Protestants, which he did not intend to keep, and to which they never trusted.

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Origin of a third party, A. D. 1574.

In the following year, A. D. 1574, a third party arose in France, which, without paying the least attention to the religious disputes and differences of the other two parties, confined their efforts entirely to politics: they were called the Malcontents. Their avowed object was to reform the political state of the kingdom, by setting limits to the power and influence of the Guises; excluding the queen from the administration of affairs; and banishing from the kingdom all the Italians, whom she had introduced and countenanced. The Duke of Alençon, brother to the king, a man restless, intriguing, and versatile, put himself at the head of this party.

In the midst of this disordered and embarrassed state of the kingdom, the health of Charles was rapidly declining. Ever since the massacre of Bartholomew, a deep and suspicious gloom overspread his countenance, and his mind was torn by contending passions. He still hated the Protestants; but he was alarmed at the ambitious views and extensive influence of the families of Montmorenci and Guise, while he was deeply affected by the intrigues of his brother the Duke of Alençon, and the King of Navarre. In this state of bodily weakness and mental agitation, he began to suspect that he had been too easily led by the counsels of his mother, into a line of conduct neither conducive to his peace of mind, honourable to his name, nor advantageous to his own interests, or those of his kingdom. This reflection, coming thus late, served only to increase his bodily and mental sufferings. His health declined with great rapidity: each day some new and fatal symptoms manifested themselves; and at last his disorder took a most singular turn. While a slow and internal fever preyed on his strength, the blood oozed even out of the pores of his skin. Catherine was suspected of having administered poison to him; but it is more probable, that his disorder was occasioned by the dissolute life which he had led, and by the excessive violence of his temper. For some time, such was the remaining power of a constitution naturally strong, he struggled against his disorder; but at length, in the 23d year of his age, it overcame him. His last hours were worthy of a better life, and a better character. These he spent in recommending to those around him to preserve their fidelity to the King of Poland, the heir to the throne on his decease; and he obliged all present to take an oath of fidelity to Catherine during the absence of Henry.

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Charles was not naturally devoid of qualities and talents, which, if they had not been counteracted by a most vicious education, might have rendered him a blessing to his subjects. He possessed wit, judgment, activity, and courage; but his disposition was naturally violent; and those who had the care of him in early life, especially the Marshal de Retz, had encouraged, instead of repressed, this violence. From his mother he learnt the whole mystery of the Italian school of politics, and consequently was an adept in dissimulation and intrigue. Indeed, so far did he carry this habit, that he not unfrequently preferred obtaining by deceit, what he might much more easily and certainly have acquired by open and ingenuous conduct; and his public life shews, that even the systematic dissimulation which he learnt from his mother, was as frequently prejudicial as advantageous to him. His tutor Amyot had given him a taste for learning, and he cultivated poetry.

Notwithstanding the distractions of this reign, many laws and ordinances, originating in wise and profound views of the public benefit, were passed, chiefly through the labour and patriotic efforts of the Chancellor De l'Hospital. In the midst of the civil wars, this really great man fixed his undivided attention and wishes on the good of his country; and such was the commanding influence of his character, and his activity and zeal, that at a time when law generally is trampled under foot, he made it be respected and acted upon.

Henry III. A. D. 1574.

On the death of Charles IX. the king of Poland, who succeeded him under the name of Henry III. hastened to take possession of the throne. Dreading lest the Poles should detain him, he withdrew privately, as if he had been a prisoner making his escape. As he passed through the dominions of the Emperor and the Republic of Venice, he was advised to treat the Protestants with justice, if not with gentleness and kindness, and to avoid persecuting them, if he wished to restore tranquillity to France; but this advice was given in vain to a man who had been one of the advisers of the massacre, and who, to the utmost depravity of manners, added the external observances of the lowest superstition. Scarcely was he seated on the throne of France, when he manifested a total unfitness for his situation, even independent of his bigotry and depravity; for he was totally averse to business,—occupied and interested only in the most low and trifling pursuits and objects; and utterly devoid even of the manners and dignity of a sovereign.

His character.

As the kingdom was still divided by factions, Catherine persuaded Henry to take advantage of this circumstance, and by acting as umpire between them, to restore the royal authority to its pristine dignity and extent; but the king, though not unfit for this line of conduct, in respect to his habits of dissimulation, was totally disqualified for it, on account of his want of vigour, application, and sound understanding; instead therefore of acquiring a superiority over both factions, he lost the confidence of both, and taught the partizans of each to regard him with suspicion, and to adhere more closely to their respective leaders.

In the mean time, A. D. 1575, the Duke of Alençon, who, as has already been stated, had put himself at the head of the political party, united with the Protestants, while they were further encouraged and strengthened by the presence of the King of Navarre, and by the arrival of the Prince of Condé at the head of a German army. The king upon this found himself under the necessity of concluding a treaty with them, by which they obtained the public exercise of their religion, except within two leagues of the court; party chambers, composed of an equal number of Protestants and Catholics, were established in all the parliaments of the kingdom; all attainders were reversed, and eight cautionary towns were put into their possession.

Pacifies the Protestants,

and disgusts the Catholics.

But, while Henry by this treaty pacified the Protestants, he excited the greatest disgust and indignation among the Catholics; and affording the Duke of Guise the pretext, which he had long sought, of putting himself at the head of a most formidable party, for the express purpose of entirely suppressing the Protestant religion in France. This was the origin of the famous League, the members of which openly declared, that they would withstand the royal authority in all cases where that authority was at variance with the commands or the interests of the Catholic religion. Henry now saw the error which he had committed in making peace with the Protestants; and as he possessed neither the justice nor the vigour that might have prompted and enabled him to protect the Protestants against the League, while he saw that the members of it had it in their power even to shake the foundations of his

Origin of the League.

throne, he resolved to unite himself to it, and was accordingly declared its head, and in the year 1577 he took the field as the leader of the Catholics. This circumstance was probably favourable to the temporary tranquillity of the kingdom; for the dilatory, feeble, and indecisive character of the king, prevented the troops of the League from acting with vigour or success, and a new peace was brought about, which, though less favourable than the former to the Protestants, was equally displeasing to the leaders of the Catholics. The king, now suspected by both parties, retained little weight or influence; while the Duke of Guise on one side, and the king of Navarre on the other, engaged by degrees the bulk of the nation to enlist themselves, either with the Protestants or Catholics. Foreign aid was also called in by both; the Protestants being encouraged and supplied with money by Queen Elizabeth; and Philip II. of Spain declaring himself Protector of the League; and entering into the closest correspondence with the Duke of Guise.

Civil war,
A. D. 1581.

In 1581, hostilities between the two parties commenced, and the King of Navarre signalized himself at the siege of Cahors. About the same time, the Duke of Anjou, Henry's brother, secretly retired from France, to put himself at the head of the Dutch, who had risen against Philip II.; but his caprice and perfidy disappointed the hopes which he entertained, and he was obliged to return into France, where he soon afterwards died. This event completely unfolded the real views of the members of the League; for as the king of Navarre, by the death of the Duke of Anjou, was presumptive heir of the crown, they inflamed the people with the dread of an heretic sovereign, and avowed their resolution to support the pretensions of the Cardinal of Bourbon, uncle to the King of Navarre, a zealous Papist, but incapable, from age and weakness, of holding the reins of government. In the proclamations issued by the League, the character of the king of France was not spared; he was held up to his subjects as debauched, —the instrument of unworthy favourites, and especially as the secret friend of the King of Navarre, and the protector of the sectaries of Geneva. The people were led away by these representations, and filled with the most violent bigotry.

Peace,
A. D. 1584.

In 1584, the Duke of Guise, as the general of the League, took the field; and though his army scarcely exceeded 5000 men, he gained possession of Verdun, but he was repulsed from Metz by the Duke D'Epernon. If Henry had taken advantage of this, he might have re-established his power; but he was no longer capable of any great or arduous enterprise, and he concluded a peace on the most dishonourable terms; agreeing to compel the Protestants to restore the cautionary towns, to annul all the edicts in their favour, and to join the League with all his forces. He thus virtually resigned his sovereign authority into the hands of the Duke of Guise, who nominated a council of 16 citizens for the government of the capital, and intimated to them his wish that they should take measures for dethroning their sovereign, and bestowing the crown on himself. In pursuance of this design, the inhabitants of Paris presented a memorial, in which they required the King to declare openly for the League,—to revive the Council of Trent,—to establish the inquisition, and to extirpate heresy: so low were the power and the firmness of mind of Henry sunk, that he promised to take this memorial into consideration.

The Duke
of Guise
invested
with the supreme
power.

In 1588, the Duke of Guise had the audacity, contrary to the express commands of his sovereign, to enter the city of Paris amidst the loud and universal acclamations of the citizens, and demanded an audience of him. To this, however, Henry would not consent; his timid spirit was at length roused; he declared that the death of the Duke of Guise should be the consequence of his forcing this interview. Catherine now interposed her authority, and even her tears; but in vain. Henry remained inflexible, till at length the Duke, afraid that he had passed even the limits of the king's pusillanimity, and sensible of his danger, endeavoured to disarm the royal rage by submission. He was permitted to retire; but his soul breathed indignation and revenge, and he instantly prepared for the most decisive and determined measures. Henry, at this juncture, had given orders for 6000 of the troops, on whose fidelity he could place the utmost reliance, to enter Paris: the citizens took the alarm; they were conscious of the punishment which they deserved for their insolent behaviour to their sovereign; they flew to arms; the capital became the scene of the greatest confusion and alarm; the soldiers were surrounded and overcome. Catherine now saw, that if she did not interfere, the life of her son would probably be sacrificed; she therefore entered into a private negociation with the Duke, while Henry quitted the palace, and effected his escape through the gardens of the Thuilleries. It is said that when he was safe, turning back to look at his capital, he declared that he would never enter it again except through a breach in its walls.

Dispute
between
him and the
King.

From Paris the king retired to Chartres, whence he appealed to the loyalty and duty of his subjects. His appeals were answered by the manifestoes of the Duke of Guise; but, in the midst of these mutual accusations, the efforts and intrigues of Catherine were directed to an accommodation, which she could not expect would be sincere or lasting on either side, but from which she hoped to derive advantages to her own cause. A treaty was accordingly entered into between the King and his rebellious subjects, according to which the Duke of Guise was appointed lieutenant-general of the French armies; the Cardinal of Bourbon was declared first prince of the blood; and the severest penalties were denounced against those who had presumed to leave the ancient and established religion of the country. From these terms, it is evident, that the Duke of Guise had obtained all he could wish, or had taken up arms for. He was confirmed in the chief command of the army, and the King of Navarre was excluded from the throne. Henry was soon made sensible of the ignominious conditions to which, by the advice of his mother, he had consented; and he breathed vengeance against the Duke, while he excluded Catherine from his councils. In this dilemma, he had recourse to a most bold and unexpected measure, which indicated a greater portion of decision and policy than it was supposed he possessed. He assembled the states at Blois; and though the greatest number of those who met were the partisans of the League, he boldly made his appeal to them, dwelling in the most animated and forcible manner on the distress into which he had been brought by the seditious conduct of the house of Lorraine. Had his future conduct corresponded with his behaviour before the states, he probably would have roused the latent loyalty of his subjects; but, on the remonstrances of the Duke of Guise, he softened the most obnoxious passages of his address before it was circulated through the kingdom.

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Soon after this, having received intelligence that the Duke had held a secret and treasonable correspondence the skill and caution of this celebrated commander, that he retired in the face of his enemy, without so much as putting his army into disorder.

After the retreat of the Duke, Henry again attempted to get possession of Paris: but he was defeated in all his designs, by the vigilance of the citizens, particularly by the faction of Sixteen, by whom it was now governed. Thus foiled in his grand object, he began to consider his situation and prospects in other respects, and he found them by no means favourable. When the Duke of Parma retired, he left 8000 men for the support of the League. Pope Gregory XI. at the request of the King of Spain, not only declared Henry a relapsed heretic, and ordered all Catholics to abandon him, under pain of excommunication; but sent his nephew with troops and money to join the Duke of Savoy, who was already in possession of Provence, and had entered Dauphiné. About the same time, the young Duke of Guise made his escape from the castle of Tours, where he had been confined since the assassination of his father. When Henry was informed of all these threatening circumstances, he coolly observed, "The more enemies we have, the more care we must take, and the more honour there will be in beating them."

Elizabeth, however, was still a steady and useful friend. She had, indeed, on the first prosperous appearance of Henry's affairs, withdrawn her troops; but when she saw him again menaced, she sent, in 1591, 3000 men under Sir John Norris, and afterwards 4000 under the Earl of Essex. With these supplies, joined to an army of 35,000 men, Henry entered Normandy, and undertook the siege of Rouen. This town was most obstinately defended; but at last, when it was reduced to extremities, the Duke of Parma, by order of Philip, again left his government, and advancing by rapid marches, obliged the king to raise the siege. Henry on this occasion also offered his antagonist battle; but the Duke refused it, and began his retreat. Henry pursued him, but the Duke, by wonderful generalship, in spite of the greatest obstacles and difficulties, a second time made good his retreat into the Netherlands.

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The subsequent year, the affairs of the king wore a more promising appearance in Provence, from which his general had driven the Duke of Savoy; and in Languedoc, where the commander of the troops of the League was defeated, with the loss of 2000 men. But it was impossible that the kingdom should long remain in its state of confusion and civil war; even the Catholics began to feel the bad consequences of the relaxation of all government. The faction of Sixteen had hanged the first president of the parliament of Paris, for not condemning to death a man obnoxious to them, but against whom no crime was found. The Duke of Mayence, on the other hand, had caused four of the sixteen to be executed. The Duke of Parma, on the part of the King of Spain, pressed the Duke of Mayence to call an assembly of the states, in order to deliberate on the election of a king; and the Catholics of Henry's party intimated to him, that unless he changed his religion, they would no longer support him. The states were accordingly convoked, and the Duke of Parma, under pretence of supporting their determination, was preparing to enter France with a powerful army, when the death of that general freed Henry from a most formidable enemy. The states, however, met at Paris on the 26th of January 1593; but it was soon evident, that their deliberations and resolutions would be under the influence of the Pope's legate. At the meeting, he produced a bull, requiring the French never to elect Henry, even though he should abjure heresy; while the Duke of Faria, ambassador from Philip II. demanded the throne for the Infanta of Spain, on condition that she married the young Duke of Guise. In order to induce the Duke of Mayence to agree to this demand, he was offered the duchy of Burgundy, with a large sum of money; but the Duke, unwilling to become dependent on his nephew, disputed the powers of the ambassador; and the parliament, roused from its shameful lethargy, passed an arret in conformity to the Salic law; which, being a fundamental principle of the government, they insisted could not be set aside, even under the pretext of religion.

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Henry resolves to renounce the Protestant religion.

Henry was now convinced, that even the greatest military successes could not obtain for him the confidence and loyalty of his subjects; he therefore again declared, that he was seriously desirous of being instructed in his religious faith; that he was ready to embrace the truth, as soon as he was convinced of his error; and that the incessant war carried on against him, was the sole cause why he did not employ all his thoughts on that important subject. Conferences were therefore appointed to be held between the divines of the two religions, that he might be enabled to take, with more decency, that step which the security of his throne, and the happiness of his subjects, imperiously demanded. These conferences were held at Sureure; and, as the real motive for which they were appointed was well known, the account which Sully gives is not improbable, that the Protestant divines allowed themselves to be foiled, or at least silenced in argument, in order to furnish the king with a better pretext for embracing that religion, which it was so much his interest to profess. While the Catholics contended, that there was no salvation out of the pale of their church, the Protestants acknowledged, that salvation was possible in the Roman church; and thus an easy triumph, and a strong argument, were conceded to the Catholics. This conference, however, not being sufficient to remove the scruples of the king, he afterwards conferred one or two days with some bishops; took his resolution, and performed the ceremony of abjuration at St Denis, in presence of a multitude of Parisians—the people flocking to witness the ceremony, though the Pope's legate had prohibited all men from assisting at it, under pain of excommunication. A parish priest in the capital preached nine sermons against the absolution given to the king; and in various parts of the kingdom the people were roused to rebellion, by the remarks of the clergy on that very act which Henry thought would pacify them. The Protestants behaved differently; they were convinced that the king could never succeed while he professed their religion, and as they knew he would always support them, they preferred his powerful support as a Catholic king, to his weak protection as a Protestant prince.

Though the court of Spain and the Pope in vain endeavoured to allay that satisfaction which was generally diffused over France by the conversion of Henry, yet this event did not immediately produce all the beneficial effects expected from it. The Marquis of Vitri, who, on the death of Henry III. had deserted the king, and had been appointed by the League to the command of Meaux, was the first man of rank who returned to his allegiance. He had often solicited the Duke of Mayence in vain to make peace with the king, as the cause of the war was at an end; and on receiving no satisfactory answer, he resolved to discharge what he conceived his duty required of him. He therefore ordered the garrison to evacuate the town, and, delivering the keys to the magistrates, he said, "I scorn to steal an advantage, or to make my fortune at other men's expence. I am going to pay my allegiance to the king, and I leave it in your power to act as you please." This short, but candid and honest speech, was received by shouts from the inhabitants, of "Long life to Henry IV.!" and the example of Meaux was followed by the cities of Orleans, Bourges, Lyons, and Pontoise. When the deputies from Meaux waited upon Henry, they were so confounded, that they were incapable of speech, and threw themselves at the king's feet. Having regarded them in silence for some moments, Henry burst into tears, and, lifting them up, said, "Come not, as enemies, to crave forgiveness; but come as children to a father, always willing to receive you with open arms."

Several cities acknowledge him.

The king determined to take advantage of returning prosperity to celebrate his coronation. As Rheims was still in the possession of the enemy, he was crowned at Chartres. Almost immediately afterwards, the provinces of Orleannois and Berri were delivered up by their respective governors to the king; and a singular accident restored the capital to him. The Duke of Mayence having been obliged to leave it, to quell some disturbances in Picardy, had entrusted the command of it to the Count de Brisac. This nobleman seems to have formed the romantic idea of establishing a republic in France; but his designs being received with contempt by the chiefs of the League, he delivered up the capital to Henry. Villars, who had so gallantly defended Rouen, soon afterwards opened the gates of that city, and proclaimed Henry king. The young Duke of Guise also made his peace; and, on the reduction of Laon by the king in person, Amiens, and a great part of Picardy, submitted to him.

Attempt on his life.

In the midst of his successes, his enemies resolved to assail his life. On his return from Picardy to Paris, John Chastel, a scholar of the college of the Jesuits, struck him on the mouth with a knife, as, in the apartments of the Louvre, he stooped to embrace a nobleman that was presented to him. The blow was intended for his throat, but his stooping prevented it touching that dangerous part. Chastel was instantly seized, and delivered over to condign punishment. On his examination, he confessed that he had been prompted to this deed by hearing his preceptors assert, that the murder of kings was lawful, and that as Henry had not yet been absolved by the Pope, he ought still to be regarded and treated as a heretic: hence he inferred that it would be a merit to put him to death. Father Guiscard, on whom were found some writings, which inculcated the same doctrine, was also executed, and all the Jesuits were banished by a decree of the parliament of Paris.

Defeats the Duke of Mayence, A. D. 1595

In 1595, Henry entered the city of Dijon in Burgundy, convinced that his life would be safest while he was in the midst of his troops, and engaged in military affairs. Scarcely, however, had he made himself master of Troyes, before he learnt that the Duke of Mayence, in conjunction with the Spaniards, had crossed the Saone. He immediately resolved to attack them; and conducted himself on this occasion with so much boldness and impetuosity, that, with only 1800 troops, he routed an army of 14,000 men. In Picardy, however, his cause was not so fortunate; the Spanish army invading that province, and reducing several cities of importance, which Henry himself, in compliance with the ambition of his mistress, the fair Gabrielle D'Etrees, who wanted a principality for her son, was employed in a fruitless expedition into Franche Compté. In the subsequent year 1596, the Duke of Guise surprised Marseilles. When Henry was informed of this event, he was so much transported, that he exclaimed, "Then I am at last a king!" The Duke of Mayence, suspecting the sincerity of the Spaniards, from their inactivity and want of zeal, determined to separate himself from them; but he had formed a resolution never to acknowledge Henry, till that monarch had been absolved by the Pope. Henry, being made acquainted with his scruples, secretly suggested to him to retire to Chalons, till his Holiness granted his absolution; and the Duke had scarcely reached that place, when the Roman Pontiff, fully convinced that Henry was firmly established on the throne, absolved him in form. The Duke immediately threw himself at the feet of the sovereign, and vowed a fidelity which he proved to be conscientious, by his future conduct.

A. D. 159

Soon after these events, the Archduke Albert, who was now governor of the Netherlands, sent an army to besiege Calais, which was obliged to surrender, before the king could come to its assistance. This calamity was soon followed by another still more grievous, for Amiens was taken by surprise by the Spaniards. Nor were the demands on the king's firmness and mental resources yet exhausted; he was harassed by the complaints of the Protestants, who expected that he would have granted them additional protection and privileges; and the Dukes of Savoy and Morceur, still refused to acknowledge his authority, unless on conditions with which he did not deem it proper to comply. The king at this time labouring under a severe indisposition, felt these misfortunes more keenly; and his difficulties were greatly increased by the exhausted state of his finances. He was therefore under the necessity of assembling his nobles, and making them acquainted with the real state of his affairs; "I have not called you together," said he, "as my predecessors used to do, to oblige you to adopt my measures, or implicitly obey my will: I have assembled you, to take your advice, to which I will listen with attention and candour, and with a firm resolution to follow it, provided it will benefit the country." But the nobility, though disposed to give their advice, were not in a condition to assist their sovereign in carrying into effect the measures which they recommended; they were exhausted and dispirited. "Give me an army," cried he, "and I will cheerfully sacrifice my life for the state." Troops they could supply him with; but as he complained, bread for these troops could not be procured.

Troubles of Henry.

In this critical and embarrassing situation, he had the good sense to appoint the Marquis de Rosny, afterwards the celebrated Duke of Sully, superintendant of the finances; and he soon placed the king in a situation to support the expences of the war. His financial measures were wise and efficacious, at the same time that they were not burdensome to the people. By means of them, Henry in a short time was at the head of an army of 20,000 men, the best appointed that he had ever commanded. Elizabeth reinforced this army with 4000 troops; so that in 1597, the king deemed himself sufficiently strong to attempt the recovery of Amiens. "Let us go," said he, on setting out on this expedition, "and act the King of Navarre; we have acted the King of France long enough." The enterprise was

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worthy of the talents of the King; for the Spanish garrison was composed of excellent troops, and commanded by brave and experienced officers. As they were sensible of the great importance of the place, and knew that on that account the Archduke would march to its relief, they made a most obstinate and gallant defence. The Archduke did indeed advance to it, but not being able to force the French lines, though his army was composed of 25,000 excellent troops, he retired, and Amiens surrendered to Henry. The next enterprise of this monarch was against Dourlens, which he also hoped to take: But his troops were fatigued; disease and discontent began to prevail among them; the works went slowly on from these causes, and the unfavourable weather; the artillery could not be brought up, in consequence of the badness of the roads; and the vigilance of the Archduke had prepared the city with every thing necessary for its defence. Henry, therefore, had scarcely begun the siege, before he was convinced that it would be wise to abandon it; he accordingly disbanded the greater part of his troops, and leaving his cavalry for the defence of the frontier, returned to Paris. Here he was received with every mark of loyalty and attachment; but his stay could not be long, for Brittany still was in possession of the League; and the Duke of Morceur, of the family of Lorraine, nourished the flames of sedition there. The King, therefore, as soon as the return of spring permitted his troops to march, advanced to Angers. The Duke taken unawares, and deserted by the principal part of the nobility, considered himself as utterly lost, when the lucky thought presented itself of offering his daughter, the heiress of his large estates, to Cæsar, the natural son of Henry, by his mistress Gabrielle d'Estrées. The King, glad of an opportunity of gratifying her ambition, readily assented to the proposal, and the nuptials were celebrated with princely magnificence at Angers.

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The King of Spain, who had hitherto kept alive the civil war in France, seeing the League destroyed, and being broken down with age and infirmity, felt a sincere desire for peace. As Henry was equally solicitous for it, the mediation of Pope Clement was readily accepted, and at his request a congress was held, by the plenipotentiaries of France and Spain, at Vervins, a town in Picardy. While the negociations were carrying on, Henry bethought himself in what manner he might satisfy the Protestants, without offending the Catholics, or exciting their suspicions. This was no easy task; but he effected it in a wise and politic manner, by passing the famous edict of Nantes in favour of the Protestants. This edict confirmed to them all the rights and privileges which had been granted to them by former princes, and it added a free admission to all employments of trust, profit, and honour; an establishment of chambers of justice, in which the members of the two religions were equal; and liberty to educate their children without restraint in any of the universities. The negociations at Vervins were attended with considerable difficulties, but these being removed principally by means of the Pope, Henry signed a peace, by which he obtained the restitution of Calais, Ardres, Dourlens, and all the towns of France which Spain had wrested from him, but at the same time gave up his pretensions to Cambray.

Henry's efforts to improve the state of France.

When this peace was concluded in 1598, France stood much in need of repose. The crown was loaded with debts and pensions; the country was uncultivated; the people were poor and miserable; and the nobility, long accustomed to a life of rebellion and plunder, were destitute of all sense of justice, moderation, or loyalty. Henry, therefore, was convinced, that a still more arduous task remained for him than any he had yet undertaken; and that it would be necessary to bring all his powers of mind into action, if he wished to restore happiness to France. He was also convinced, that the measures which it would be necessary to pursue, would meet with violent opposition from all those, whose habits and interests attached them to rapine and disorder; but he was neither intimidated at the greatness, nor perplexed by the intricacy, of the task which he undertook. No man indeed was better qualified for it.

Character of Sully.

His object was single; he suffered no thought or wish to interfere with his desire for the public good; and his talents were of that description, that what he desired ardently and sincerely, he could examine in all its bearings, and ascertain every possible mode by which it could be accomplished. He was aware that he must proceed with caution, and that many must be enticed to do or permit, what, if they were ordered to do, or reasoned with, they would undoubtedly oppose. Among all men of the military profession, he possessed great influence, from his success in war, and his courageous and open disposition; while, to the nobility in general, he was recommended by his magnanimity, gallantry and gaiety. The people loved and reverenced him; they were convinced, that all his actions were directed to their good, and they even gave him credit for aiming at it, when their ignorance or their passions prevented them from perceiving in what manner his measures would promote it. As the more violent and factious had experienced his vigour and promptitude, they were afraid to excite his suspicion, by opposing his schemes. Thus he found himself in a condition to undertake the mighty and benevolent work of regenerating France, and of curing the wounds which a long civil war had inflicted on her morals, her happiness, and her finances. Still, however, the task was too great for one mind, even of the highest talents, and purest views. Henry, therefore, called to his assistance the Marquis de Rosny, whom he created Duke of Sully. This justly celebrated man, in some respects resembled his master; and where he did not resemble him, the difference was such, as rendered their dispositions and talents mutually beneficial, instead of antagonist to each other. Henry was naturally fond of pleasure, and of a volatile temper; hence he required a steady and thoughtful friend, possessed of more coolness and perseverance than himself: this friend he found in Sully. "Attached to his master's person by friendship, and to his interest and the public good by principle, he employed himself with the most indefatigable industry to restore the dignity of the crown without giving umbrage to the nobility, or trespassing on the rights of the people." As all these plans of reform and amelioration depended on the restoration of the finances, Sully first applied his attention to them, and, in a very short time, he exhibited a statement of them so simple, clear, and satisfactory, digesting the whole system into tables, that the King became perfectly master of his own affairs, and was able, by a single glance, to see all the branches of his revenue and expenditure. As it was one of Sully's maxims, that every man employed in collecting the revenue was a citizen lost to the public, and yet maintained by the public, he levied taxes in the shortest and most frugal manner; all the expences of the government were curtailed: but those which were necessary, were paid in a punctual and regular manner; and he took especial care, that the King should always have so much in reserve, as could relieve him from the necessity, on any unexpected emergency, of either borrowing, or imposing new taxes. As all these measures were the result of a comprehensive and well-digested system, and as both Henry and his minister were convinced that they were founded in wisdom, and would prove advantageous, they did not permit any deviation or relaxation in their execution. The consequence was, that in the space of five years, all the debts of the crown were paid; the revenue was augmented four millions of livres; and there were four millions of surplus above the regular expenditure in the treasury, while the taxes were much reduced.

Though Sully was convinced that while the finances of a kingdom were embarrassed, the operations of government must be obstructed, and the people so depressed and destitute of confidence in it, as not to co-operate with it in giving due effect to its laws and regulations, and consequently viewed the re-establishment of the finances as a measure first demanding his attention, he by no means regarded it as of the highest importance. His maxim was, that good morals and good laws are reciprocally formed by each other; and as he could not doubt, that good morals constituted the real strength and happiness of a nation, he resolved to secure them by enacting good laws, and by every other method which his penetration and sagacity could devise. He was, indeed, not one of those politicians, who coldly, as well as unwisely, regard the real stength of a nation to consist entirely in its pecuniary resources, or even in its powers to carry on war on an extended scale. On the contrary, he was deeply impressed with the conviction, that, even looking to superiority among other nations exclusively, that would be obtained in the most certain and direct manner, by cultivating the moral feelings and knowledge of the people, so as, in the event of a contest which they regarded as just, their moral courage might be in full vigour and activity. He therefore examined carefully the existing laws; the effects which they produced, not merely with respect to the particular crimes which they were intended to prevent, or punish, but also with respect to the general influence they had on the opinions and conduct of the people. He also inquired into the mode in which they were carried into execution; and after having made these inquiries, he warmly co-operated with the king, in repealing such as were hurtful or useless, and in enacting others that were more effective and beneficial, or that the circumstances of society demanded.

In Sully's character, there was a grand and dignified simplicity, which accorded better with the manners, than with the feelings and wishes of Henry; for though that monarch, in his private life, was free from all unnecessary pomp, and enjoyed himself most, when the king was forgotten in the friend or companion, yet his gallantry and love of pleasure, too often led him aside from the path of simplicity, and to prefer ostentation and show. Sully, on the contrary, could not suffer himself to entertain the idea, that luxury was not prejudicial, both to the moral feelings and principles, and to the real strength of a people. He therefore patronised most warmly agricultural pursuits, and seems to have formed the idea, that an agricultural nation possessed within itself all that was necessary for its happiness and security, while its morals were carefully guarded from laxity or corruption. To manufactures he was a decided enemy, considering, that though they might increase the wealth of a people, and its means of enjoyment, yet that wealth must be obtained at the expence of its virtue; and the kinds of enjoyment thus acquired, must be at the expence of that relish for the simple and austere virtues, which alone could render them dignified, and truly independent. But Henry, in this respect, acted differently from the views of his minister; for, contrary to his opinion, he introduced the culture and manufacture of silk; and, before his death, it flourished so extensively, that it brought more money into the kingdom than any of the former staple commodities. He also established, at a great expence, manufactures of linen and tapestry; obtaining the workmen for the first from the United Provinces; and for the last from the Spanish Netherlands. His maxim was to give high wages and great encouragement, in other respects, by making the workmen feel that they were at home, and that they had an interest in the country. In order to facilitate commerce, and promote the convenience of his subjects, he built the Pont Neuf, and cut the canal of Briare, which joins the Seine and Loire.

Sully patronises agriculture.

Henry patronises manufactures.

Unhappy in domestic life.

But Henry was not happy in domestic life. His Queen, Margaret, sister to Charles IX. and Henry III. though she succeeded in gaining the affections of every other person whom she wished to attach to herself, yet failed to gain those of her husband. She was uncommonly beautiful; possessed of a fine and ardent imagination, and of a delicate and cultivated taste; played on the lute with exquisite skill, and danced with uncommon elegance and grace: but she was violent and unguarded in her love of pleasure; and mingling the fervours of religion with the excesses of dissipation, her time was alternately occupied by enthusiastic devotion, and unrestrained sensuality. Henry, coldly averse to her from the very period of their marriage, was by no means select in his amours, except when some woman of uncommon beauty and accomplishments captivated him. For some considerable time before the peace of Vervins, Gabrielle D'Estrees, whom he had successively created marchioness of Monceaux, and Duchess of Beaufort, had fixed his love. By him she had two sons and a daughter. As Margaret and he were equally anxious for a divorce, Henry entertained the thoughts of raising Gabrielle to the throne, and of legitimating his natural children; but when his intention was made known to the queen and to the Pope, who had already agreed to sanction the divorce, they expressed the most pointed disapprobation of it. Henry, however, was resolute, and probably would have persevered in carrying his intention into effect, had it not been frustrated by the sudden death of his mistress. His grief, at first, was inconsolable; but he could not live without feeling the tender passion. The next object of it was Henriette de Balzac, daughter to Balzac Entragues, by Mary Touchet, the mistress of Charles IX. He immediately created her Marchioness of Verneuil, and even made out a promise of marriage, notwithstanding he was not yet divorced from Margaret. This promise he shewed to Sully, who tore it to pieces. "I believe you are turned a fool," said Henry. "I know it," replied Sully, "and I wish I were the only fool in France." Notwithstanding this daring and virtuous freedom of Sully, Henry was so sensible of his real worth, and sincere attachment to him, that, so far from being offended, Is vorced from his queen, A.D. 1599.

he added to his former employments that of master of the ordnance. At length, in 1599, the sentence of divorce, which he had so long and ardently desired, was procured from the court of Rome. But, by this time, *Henry's* passion was cooled; and reflection taught him, that he had been on the point of staining his character and injuring his people, when he made out the promise to marry his mistress. He therefore resolved to be guided in his second marriage, solely by the consideration of what would most benefit France; and, in order to effect this, and please his subjects, he nominated Mary de Medicis, niece to the grand Duke of Tuscany. But having done this, in compliance with the wishes of his people, and from a conviction that thus he had served their interests, he did not scruple again to deliver himself up to gallantry; and his attachment to the Marchioness of Verneuil was the frequent cause of disagreements between him and his queen.

And marries Mary de Medicis.

In the mean time, the intrigues of the court of Spain gave him great uneasiness and alarm. His ancient and inveterate enemy Philip was indeed no more, but his successor inherited his designs of molesting the throne of Henry, and incited the Duke of Savoy to make war against him. The Duke, however, soon experienced the evil consequences of his proceedings. Bresse, Savoy, and Nice, were immediately subdued by the armies of France; and in a very short time, finding himself not supported, as he expected, by Spain, he implored the mediation of the Pope to extricate him out of a war into which he had thus rashly plunged. In 1601, therefore, a treaty was accordingly formed, on condition that the Duke should cede to Henry the country of Bresse, an extensive territory on the banks of the Rhine, and pay 100,000 crowns to defray the expences of the war. The Duke, during the war, had engaged in a secret correspondence with the Marshal Biron, who, boasting that he had placed Henry on the throne of France, did not conceive himself sufficiently rewarded for his services, and felt himself humbled, during peace, by his total ignorance even of the lowest branches of learning. These motives and feelings operated to make him wish again for war; and even at the time when he was leading the French armies into the territories of the Duke of Savoy, he was engaged in a correspondence with that prince. This correspondence had not escaped the vigilant attention of the king, who, when at Lyons, reproached him with his seditious designs. The Marshal acknowledged his crime; professed his repentance; protested future fidelity; and thus succeeded in obtaining the forgiveness of his sovereign, who endeavoured still farther to awaken his gratitude, by the grant of a large sum of money; and to keep him out of the way of future guilt, by appointing him ambassador first to the court of England, and afterwards to the Swiss cantons. But the Marshal had no sooner returned from these embassies, than he resumed his ambitious projects; entered into an alliance with the courts of Spain and Turin; and succeeded in drawing over the Duke of Bouillon, and the Count d'Auvergne, natural son to Charles IX. Circumstances seemed favourable to the plans of the conspirators; disaffection was widely spread though France, in consequence of Henry's yielding to the influence of his mistress in the improper nomination to ecclesiastical dignities; his neglect of the Protestants; and the numerous imports which it was necessary to lay on, in order to support the state. These complaints, in some respects well-grounded, in other respects without foundation, were listened to and encouraged by the Marshal and his associates; and as the counties of Anjou, Poitou, Saintonge, Auvergne, Guienne and Languedoc, were in a state of revolt, they already anticipated the overthrow of the power of Henry. But their hopes and plans were disappointed. They had employed a person of the name of La Fin in their most secret intrigues, who, in a moment of disgust, revealed to Henry the whole of the conspiracy. Henry did not hesitate for the shortest period, in what manner he ought to act; but first went into the seditious provinces, and having overawed the people by his firmness, or brought them back to their duty by his popular manners, and by the recollection of what he had done and suffered for France, he returned to Fontainebleau, determined to bring the principal conspirators to the block, before they were strengthened by the troops of Spain and Savoy. Biron was at this time in his government of Burgundy, strengthening the most important cities in that province, when he received an order from Sully, as master general of the ordnance, to send back the cannon of Burgundy, under pretence of new casting them. No sooner, however, were they transported beyond the government of Biron, than Sully stopped the new ones, with which he had promised to replace them. This first excited the suspicions of Biron, which were confirmed by his learning that La Fin had had a private conference with the king. He now lost all his courage and presence of mind; and though he could not hope for the royal clemency, yet such was his agitation, that he obeyed the summons of Henry, and along with the Count D'Auvergne, repaired to Fontainebleau. Henry still wished, if possible, to save him; and, for this purpose, endeavoured to lead him to a full confession of his guilt, in order that he might justify his clemency; but the Marshal was obstinate; and Henry was at length compelled to give way to the regular proceedings of justice. The proofs being clear and positive, the judges unanimously pronounced the sentence of death. At the place of execution, Biron behaved in a manner by no means becoming his situation, or agreeably to his former conduct; for he was seized by alternate fits of terror and rage, and thus disgraced, in his last moments, the character of Intrepid, which he had acquired amidst the dangers of war.

achery Biron, D. 1601.

Biron executed.

Henry advances against the Duke of Bouillon.

The Duke of Bouillon was yet in arms, and refused to obey the royal summons for his appearance at court. Henry, therefore, determined by his presence to reduce this rebellious subject. Accordingly he directed his course through the provinces of Auvergne and Limousin, and approached where Bouillon was, before that nobleman suspected he had left Fontainebleau. Astonished, therefore, and unprepared for resistance, he ordered the governors of the towns which belonged to him to open their gates, and thus by his apparent sincerity succeeded in disarming the resentment of his sovereign. Scarcely, however, had Henry returned to Paris, when the restless and discontented disposition of the Duke again broke out into acts of sedition; and he found it absolutely necessary to crush him at once and effectually. With a small but well-appointed body of infantry, supported by a train of artillery, under the command of the Duke of Sully, he pressed forward to Sedan; and Bouillon again began to consider his situation dangerous. On Spain he could not rely; the Protestants, with whom he had been a great favourite, were shocked at his disloyalty, and flocked to the standard of the King. He therefore again threw himself on the royal mercy, and, however unworthy, obtained it.

Disagreement with his Queen.

Henry about this period, experienced a greater share of domestic unhappiness than ever. The temper and habits of the Queen were utterly at variance with his. She was cold, indifferent, and reserved; blindly attached to her Italian favourites, and regardless of the wishes or interests of the King. Such a temper and conduct were ill calculated to draw him from those amours, to which he was so much addicted. The Queen complained of them, at the very time when she was rendering her own society repelling and disagreeable to her husband. Hence the inmost recesses of the palace were disturbed by their mutual and incessant complaints; and Sully, whose good offices were always required on these occasions, often found the utmost difficulty in accommodating these quarrels. The King, wearied out with the arrogance of the Marchioness of Verneuil, sought a new mistress; and was captivated by the wit and sprightliness of the daughter of the constable, Charlotte de Montmorency. So ardent was his passion for this lady, and so completely did it obscure his good sense, and pollute the purity and honour of his mind, that he formed the disgraceful resolution of marrying her to the Prince of Condé, that thus he might introduce her into his own family. The Prince, soon after his marriage, discovered that Henry was still attached to his wife, and he desired leave to quit the court. This the King positively refused, and thus confirmed the suspicions of the Prince, who immediately formed the plan of secretly escaping with his wife beyond the limits of the kingdom. He reached Landrecy in safety, when the King, hearing of his flight, and transported with rage and grief, dispatched the captain of his guards to demand the fugitives from the Archduke; but Albert replied, "that he had never violated the laws of nations on any occasion whatever, and that he could not begin with a prince of the blood royal of France." The Prince and his wife afterwards took up their abode at Brussels; but Henry, instead of being recalled to a sense of duty and respect for his own character by the reply of the Archduke, first ineffectually attempted to carry off the Princess, and then commanded the parliament to pass an arret against the Prince, and to condemn him to suffer whatever punishment he might chuse to inflict.

His dishonourable attachment to Charlotte de Montmorency.

Henry arms against Austria, A. D. 1609.

In 1609, a dispute arose concerning the succession to the duchies of Cleves and Juliers, which afforded Henry a pretext for taking up arms, and with the real view of humbling the House of Austria, and circumscribing its power in Italy and Germany. On the death of John William, Duke of Cleves, a number of competitors arose; and it appearing to two of them, who were Protestant princes, that the Emperor meant to take possession of the vacant territory, they applied first to the Evangelical Union, a confederacy of Protestants, which had been recently formed in Germany, and, as the Emperor was in alliance with the Pope and the King of Spain, afterwards to France. Henry now had a sufficient excuse for breaking openly with the House of Austria; and the refusal of the Archduke to deliver up the Prince and Princess of Condé happening at the same time, private revenge united with public policy in inducing him to receive the Protestant envoys most favourably for their wishes. He therefore renewed his ancient alliance with the United Provinces, and cultivated the friendship of England; while the Protestant princes of Germany readily united with him in his plan for humbling the House of Austria. Even the Duke of Savoy, induced by the expectation of acquiring the duchy of Milan, if it could be wrested from Austria, agreed to join the confederacy, and to give up Savoy to France; and the Italian states, long worn out by continued warfare, and constantly exposed to irruptions from Germany, Spain, and France, associated in the design, in the hope of possessing undisturbed tranquillity and national independence for the future. But it is highly probable, that the design of Henry went much farther, than merely to humble the pride, and reduce the resources and strength of the House of Austria. This might have been the immediate and primary object, but there is good reason to believe, that the plan of a Christian commonwealth, as it is exhibited in Sully's Memoirs, was seriously entertained by Henry.

His great design.

Concerning this scheme, there have been various ideas. To some it appears so romantic, that they cannot believe that it ever actually engaged the attention, or excited the hopes of such men as Henry and Sully; but that a plan was really formed, which was known by the appellation of the *grand design*, there can be no doubt. According to it, Europe was to be divided into fifteen states, so arranged with respect to situation, and so poised with respect to strength and resources, that there would either be no grounds for war, or no probability of any state carrying it on with success. In order to compose these 15 states, the smaller ones were to be united with the greater, and all of them were to be bound together by a well-digested system, such as would render it the interest of all to preserve peace. When we seriously reflect on the romantic nature of this plan, it is scarcely possible to conceive it could have been entertained by Henry or Sully; and we are compelled to believe, that its object was at the same time more practicable, and less disinterested. In fact, if we consider the knowledge of mankind, which they both possessed; the experience they had of the difficulties attending even the arrangement of petty concerns, where different states were interested, and the little probability that any object not connected with the interest of France, would rouse their attention, or excite their wishes; we shall be induced to believe, that the aggrandisement of their own country was the final end at which they aimed in their grand design. Or if this conclusion cannot be admitted, there seems no doubt, that the fifteen associated states into which Europe was to be divided, were to be formed solely by means of compulsion; and that the wishes and the interests of those concerned, at least of the inferior states, were not to be consulted.

That the object, whatever it was, which Henry had in view, was to be reached by force of arms, is evident by the great preparations which he made at this time. Besides the armies which his allies promised to bring into the field, he himself had 40,000 men, chiefly veteran and well-disciplined troops. Sully assured him there were forty millions in the treasury; and added, "If you do not increase your army beyond 40,000, I will engage to supply you with money sufficient for the prosecution of the war, without being under the necessity of imposing any new taxes."

Prepa go r the arm.

Henry resolved to command his army in person, and accordingly made preparations for setting out from his capital. He appointed the Queen regent; but she insisting on being crowned before his departure, his stay in the capital was necessarily prolonged. In the mean time, as his route lay through Flanders, he demanded permission from the Archduke Charles to march through his territories; though the court of Austria must have entertained suspicions of the real object of so great an armament, and such immense preparations, yet, as the Archduke was not prepared for resistance, he answered in terms of respectful acquiescence. Nothing now retarded his departure, but the coronation of the queen. Sully informs us, the thoughts of this ceremony disquieted him greatly, and that he felt an inward, unaccountable, and obscure dread of some approaching misfortune. It is probable that the greatness of the object which he had in view, might have impressed his manners and countenance with unusual gravity; and that this afterwards was attributed to a presentiment of his fate. At the same time, it must be admitted, that the recollection of the narrow escapes which he had often made, and of the opportunity which a crowd afforded of attacking his life, could hardly fail to arise in his mind; and if it did occur, must have rendered him unquiet and melancholy. Besides, he had often been displeased with the attention and indulgence which the queen displayed to her Italian favourites; and he might apprehend that, during his absence, they would conduct themselves with more than their usual audacity, and excite the murmurs of the people. Notwithstanding these apprehensions, however, and the dislike which he uniformly expressed, and sincerely felt, for pageantry and ostentation, he agreed that the coronation should take place, and even to be present at it. The ceremony was accordingly performed on Thursday the 13th May 1610, with the utmost magnificence. The next Sunday was fixed for the public entry of the queen, and on the Wednesday following, Henry had resolved to quit Paris, and to put himself at the head of his army.

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But the termination of the life of this really great king was near at hand. Francis Ravilliac had travelled from Angouleme, his native province, to Paris, in order to procure a livelihood; but being disappointed, and reduced to extreme poverty and wretchedness, he conceived the design of arming his hand against the King of France. Soon after he arrived in the capital, he conducted himself in such a manner as plainly proved him to be a wild and frantic visionary; and this frame of mind must have been rendered still more predominating by the distress under which he laboured. Being a bigotted Catholic, he regarded Henry, as he was going to assist the Protestants, as still a heretic at heart. Thus maddened by enthusiasm, distress, and bigotry, he watched an opportunity of striking the fatal blow. Henry had proposed to visit the arsenal on the morning of the day after the coronation; but he postponed his intention, in consequence of the indisposition of Sully, till the afternoon, when, finding himself disquieted and restless, he ordered his coach; and, accompanied by the Dukes of Epernon and Montbazon, the Marshals Lavardin and Roquelaire, the Marquises de la Force and Mirabeau, and Du Plessis, Liancourt, his master of the horse, he determined to proceed to the arsenal. The captain of the guards was ordered to the palace to hasten the preparations for the queen's entry; and the carriage was escorted only by a small number of gentlemen on horseback and the royal footmen. That the king might have a full and unobstructed view of the various ornaments and devices which the citizens had prepared on the occasion, the curtains of the carriage were drawn up on every side. No interruption took place till they came to a narrow street, where the coach was stopped by the accidental meeting of two carts. Most part of the attendants, on this, took a nearer way, and only two footmen were left, one of whom went forward to clear the passage, and the other was accidentally detained behind. Ravilliac, who had been watching a fit opportunity to execute his purpose, instantly stept forward, mounted the wheel of the carriage, and, as the king turned to read a letter to the Duke of Epernon, he stabbed him over the Duke's shoulder. Henry had scarcely time to exclaim, "I am wounded!" before a second blow, more fatally directed, pierced his heart; and, breathing only a deep sigh, he sunk down lifeless. The assassin did not attempt to escape, but remained supporting himself on the wheel of the coach, with the bloody knife in his hand, till he was seized. He would immediately have been torn in pieces by the king's attendants, had not the Duke of Epernon interfered. The same nobleman quieted the apprehensions of the multitude, by assuring them that the king was merely wounded, and that they were carrying him to the Louvre, in order to have his wounds dressed. The crowd instantly gave way; and the body being conveyed to the palace, was laid upon a bed; but it is said, that it was soon deserted by most of those who so lately had courted the protection and favour of their sovereign.

The most dreadful tortures were inflicted on Ravilliac: his bones were broken by the arms of the executioner: his flesh was torn by hot pincers: into the wounds thus made, scalding lead and oil were poured; and his mangled body, still quivering with life, was delivered to be torn to pieces by four horses. Even after all these excruciating torments, the vital principle was not destroyed, when the multitude, mad with rage, rushed through the guards, and in an instant the last spark of life was extinguished. In the midst of all his torments, he persisted, that it was entirely his own act, and that he had no accomplice; declaring, that, "impressed with the idea that the armaments of Henry were destined against the Catholic church, he alone had planned, and was privy to the deed, but that he was now convinced of his guilt, and trusted that his sufferings in this world would atone for it."

His character.

Of the character of Henry, we have already sketched the leading features, as well as pointed out the benefits which, during his reign, he bestowed on his subjects; but the extreme rarity of such an assemblage of excellent qualities in a sovereign, will authorise us to recur to the subject. His master virtue undoubtedly was his love for his country; not a cold, abstract, or unenlightened love, but that feeling which constitutes the rarest and highest order of patriotism, which leads him, in whose breast it dwells, to be zealous of his country's rights, to be anxious for its happiness, and most keen and penetrating in examining into the means that will best promote it: while such a person is by no means blind to the imperfections or vices which may prevail in it, but, on the contrary, convinced that they are the enemies of his country's happiness, his patriotism induces him to acknowledge their existence, and to use his utmost efforts to extirpate them. Under the direction of this warm and exalted patriotism, all the talents of Henry's powerful and well cultivated mind, were brought into exercise. His chief weakness was undoubtedly his inordinate passion for women, which led him into many irregularities; but this was a blemish rather in his private character, for he never permitted his mistresses to direct his councils, or to influence him in the choice of his servants. It must be confessed, however, that the manners of the nation, at least of the court, were rendered loose and profligate by the example of his libertine conduct: and this loose-

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ness of manners gave rise to other consequences equally fatal; for 4000 French gentlemen are said to have been killed in single combats, chiefly arising from amorous quarrels, during the first eighteen years of his reign. As a general, his talents were undoubtedly high; though his success ought, perhaps, rather to be ascribed to the confidence and affection with which he inspired his officers and soldiers, than to the comprehensive plans on which he conducted his campaigns, or the masterly manœuvres which he put in practice during an engagement. Having been accustomed to the profession of arms from his earliest youth, he not only set an example of labour, sobriety, and courage, but charmed the soldiers by his behaviour and discourse, which entertained them by its sprightliness and vivacity, at the same time that it convinced them that he was really their father and friend. It is scarcely possible to conceive with what eagerness even the common soldiers endeavoured, by their conduct, to deserve his approbation; and it was not because they thus hoped to be substantially rewarded, for the least expression of praise from him was hailed with rapture, and acquired inestimable value.

Nor were the soldiers the only class among his subjects who regarded him with the affection of children. The same feeling towards him possessed the breasts of most Frenchmen,—even of those who differed from him with respect to religion, while he was a Protestant, and who suspected his sincerity when he professed himself a Catholic. Of this, they gave such undoubted proofs, as amply to justify the reply of Henry to the Duke of Savoy, when he asked him what the revenue of France amounted to;—"To what I please; for having the hearts of my people, they will grant me whatever I ask; if God sees proper to spare my life, I will take care that France shall be in such a condition, that every peasant in it shall be able to have a fowl in his pot." The houses of some peasants in Champagne having been pillaged by the soldiery, the King sent for their officers, who happened to be at Paris, and commanded them instantly to repair to Champagne, and restore order, and punish the criminals. "What," said he, "if they ruin my people, who shall support me; how will the finances be supported; who will pay you, sirs? To plunder my people is to plunder me." He was extremely attentive to his officers, and they did not hesitate to consult him respecting all their distresses and difficulties. The Spanish ambassador, expressing his surprise at finding him one day almost besieged by them, the King replied, "If you saw me during a battle, they then gather still more closely round me."

But though he was thus affable, he knew when it was his duty to be firm and resolute. A person of considerable rank and influence asked a favour for his nephew, who had been guilty of murder. His reply was at once dignified, without being harsh. "I am sorry it is not in my power to grant your request. It becomes you to act as the uncle; it becomes me to act as the King. I excuse your request; do you excuse my refusal."

To these rare and excellent qualities of the head and heart, Henry added a most prepossessing physiognomy, which at once commanded respect, and inspired affection and esteem. He was of middle stature; of a fine complexion, a broad forehead, penetrating eyes, an aquiline nose, and brown hair, which however began to turn grey when he was only 33 years old. On this happening, he remarked, that the storm of adversity had early commenced to blow against him.

Such was Henry IV. a sovereign who restored tranquillity to his kingdom; who put an end to the League and to the religious wars which had so long laid it waste, and rendered the feelings and habits of the people barbarous, and averse to regular and industrious pursuits; who introduced order and economy into the administration of the finances, made himself beloved by Frenchmen, and respected by foreigners; and who, in short, reigned gloriously, in spite of so many obstacles, so many disorders, and so many enemies.

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By Mary de Medicis he had six children, and eight by his different mistresses, besides those whom he did not acknowledge.

He was in the 58th year of his age, and the 21st of his reign, when he was assassinated.

Louis XIII.

Louis, the eldest of Henry's three sons, by Mary de Medicis, was only in the ninth year of his age at his father's death, and consequently it was necessary to appoint a regent. A parliament was held, at which the Duke of Epernon, laying his hand on the hilt of his sword, said in a threatening tone, "It is still in its scabbard, but shall be drawn, if the queen is not this moment granted a title, which is her right by the order of nature, and the rules of justice." The parliament intimidated, though the decision of this business did not properly belong to them but to the States General, instantly passed an arret, appointing Mary de Medicis regent. As she was a woman of a very weak character, she soon became the dupe and instrument of her Italian confidents and favourites. Concini, a native of Florence, Marquis D'Ancre, afterwards Marshal of France, and his wife Eleanora Galegai, possessed an entire ascendency over her mind, and directed the affairs of the state as they pleased. The Duke of Sully, perceiving that he was no longer capable of benefiting his country by his advice or services, and disgusted with what was going on, indignantly retired from court to his estates, resigning his offices of governor of the Bastile, and superintendant of the finances; but he was persuaded, by his regard to the interests of the Protestants, to retain his situations as Master of the Ordnance, and Governor of the province of Poitou. Still, however, when his experience or sagacity could be of service to his king or country, he returned to Paris; and, on one of these occasions, the courtiers ridiculing his dress and manners, he said to Louis, "When the king, your father, did me the honour to consult me, he first dismissed all the buffoons and fops of the court."

Mary de Medicis regent.

Her plan.

The political conduct of the French court was now completely changed: Instead of pursuing Henry's plan for humbling the House of Austria, the Regent, perceiving that her conduct, especially in giving such countenance and influence to her foreign favourites, created disgust and discontent, and diminished her authority, determined closely to connect herself with that family. Negociations were opened, and eagerly pursued with the court of Spain; and, while the young King was contracted to the Infanta, the hand of his sister, the Princess Elizabeth, was engaged to the Prince of Asturias. The Protestants immediately took the alarm, auguring that their prosecution would immediately follow this line of foreign politics. The Duke of Rohan, in 1612, seized the strong town of St Jean, the government of which had been promised to him by Henry; alleging, as a pretext for this violent proceeding, that the Duke of Bouillon had removed the mayor, who was attached to his interest, and appointed another entirely at his own devotion. The Queen, timid by nature, and conscious that her power was still weak, immediately endeavoured to pacify,

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and thus almost justified, the Duke of Rohan, by re-appointing the mayor. The Prince of Condé, who, on learning the death of Henry, had quitted his retreat in Spain, and demanded the regency, as first prince of the blood, had been tempted to forego his claim, by the bribes of a splendid palace and a large sum of money. Still, however, he was discontented, and set himself against the Florentine favourites of the Queen; but being herself entirely guided by the Count of Soissons on the death of the latter, the Marquis D'Ancre found means to attach him to his interest.

In 1613, the Duke of Mantua dying without male issue, the Duke of Savoy, who had long wished to obtain that part of Italy, conceived that this would be a favourable moment for the accomplishment of his object. He therefore attempted to seize Montserrat, an appendage to Mantua, which was also claimed by the brother of the deceased Duke; the latter, finding himself unable to resist his opponent, applied for assistance to the Queen of France, who, in conjunction with Spain and Venice, prepared to support him. The Duke of Savoy, unable to withstand the force which they brought into the field, esteemed himself fortunate in obtaining a peace, by resigning his pretensions to Montserrat and Mantua.

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This was the only instance of vigour which the court displayed for upwards of four years. In this interval, it was filled and occupied with the most shameful intrigues which discord and anarchy, their almost unavoidable consequences, spread over the country. The princes of the blood, perceiving that they were neglected, and sensible that their united power was so great as to be equal to that which a feeble court could wield, often raised the standard of revolt, and as frequently laid down their arms, whenever the Regent, conscious of her weakness, offered them what they demanded.

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In 1614, the States-general were assembled, in compliance with the wishes of the Italian faction; but nothing of much importance occurred. The clergy, indeed, strongly urged that the decrees of the council of Trent should be published in France, but they were not successful. However, they opposed and rejected, as a rash attempt, a motion made by the third estate, that no temporal or spiritual power had a right to dispose of the kingdom, or to absolve the subjects from their oaths of allegiance. An arret of Parliament, which declared the independence of the crown to be among the fundamental laws of the kingdom, was afterwards repealed by the assembly.

In 1615, the parliament had the courage to remonstrate, in plain and strong terms, against the dissipation of the treasure which had been left by Henry IV., only two millions of which remained; and on the ruinous and unnecessary expences which were daily incurred. But an arret of council was issued in reply, declaring that the parliament had no right to interfere in affairs of state; and afterwards, the King himself, on the representations and authority of the attorney-general, gave this brief reply: "It is my pleasure, and also the queen's."

The king was now of age, but he still suffered himself to be under the guidance and authority of the queen and her favourites. In the following year, the embarrassments of the court were much increased by the conduct of the Prince of Condé, who had broke out into open rebellion, supported by the Calvinists. An army was assembled; but as there was no vigour nor plan in the councils of the court, the enterprise languished; and had the Prince persevered [illegible] would have experienced [illegible] dueing him to subjection; [illegible] violent manifesto, he persisted [illegible] laid down his arms, returned [illegible] ed in the middle of the Louvre [illegible] sonment of the Prince in the Bastile [illegible] picions and alarms of the Dukes of [illegible] ence, Nevers, and Rohan, who, accompanied [illegible] ber of the nobility, retired from court, [illegible] to take up arms. This was the signal [illegible] contents being loudly expressed; and it was [illegible] increased by the dismissal from office of [illegible] state, of Villeroy, an old favourite and faithful [illegible] of Henry IV., and by the promotion of the Bishop of Lucon, afterwards the celebrated Cardinal Richelieu, in his stead.

Civil war.

Scarcely had the Bishop taken his seat at the councils of Louis, before he infused talents and vigour into all the departments of the state. Three armies were immediately raised, and took the field, to support the royal authority; the first in Champagne, under the command of the Duke of Guise; the second in the Nivernois, commanded by the Marshal Montigni; and the third was entrusted to the Count D'Auvergne, whom the queen, drawing from the long confinement to which he had been sentenced by Henry, placed at the head of the royal forces in the Isle of France. The Duke of Guise reduced Chateau, Ponceau, and Rethel. The Marshal defeated and took prisoner the second son of the Duke of Nevers; and the Count surprised and dispersed the scattered bodies of the confederates, and shut up in Soissons the Duke of Mayence. This nobleman, son to the celebrated chief of the League in the reign of Henry, must have surrendered, had he not been preserved by an unexpected event.

The Italian favourites of Mary de Medicis arrested.

The Marquis D'Ancre, though deserted and despised by all the nobility of France, had hitherto upheld his power in spite of their efforts to destroy him; but he met with a more dangerous enemy in young Licenes, whose fortune was as remarkable as his own. Licenes had been placed by the Marquis himself about the person of the young king, into whose favour he soon ingratiated himself by his assiduities, and the ardour with which he entered into his childish amusements. The Marshal thought that no danger of rivalship could be apprehended from one who was occupied by such frivolous pursuits; but this behaviour Licenes only pursued, in order to conceal his ambitious views and designs. He soon succeeded in inspiring the king with a jealousy of the authority of the Marquis, and in persuading him to shake off the yoke of his mother. The resolution of Licenes to destroy the authority of the Marquis, was strengthened by the refusal of the latter to unite his niece to Licenes's brother. From that moment his ambition was whetted by the spirit of revenge. The king listened attentively to the repeated suggestions of Licenes, respecting the removal of the Marquis and the Italian favourites of the queen; and was struck with his representations, that his father Henry had regarded with aversion their influence over her mind, and had only been prevented, by her tears and entreaties, from sending them back to their own country. Nor was this the only topic on which he dwelt; he insisted on the unpopularity which the king was exposed to, from having imprisoned, at their suggestion, the first prince of the blood, and on the calamities which were impending over France. The restoration of tranquillity and loyalty, both among the nobility and the great mass of the people, he said, were easy; and the same means which would render the king respected and beloved by his subjects, would put him in possession of that authority of which he had been so long deprived. Louis listened attentively. At first, the habits of dependence and submission in which he had been brought up, rendered him timid and apprehensive; but afterwards, the love of power, and a sense of his own danger, from the disturbed state of the country, made him anxious to free himself from the influence of the Italians. This resolution he immediately communicated to Licenes; and, by his advice, he exacted an oath from the captain of the guard to execute what he should command. Having obtained this oath, he informed him, that the royal orders were, that he should arrest the Marquis. He immediately prepared to obey. By this time, he, as well as his wife and the queen, had intimation given them of the danger which was hangiug over them. The marchioness, intimidated, wished to leave France; but her husband declared, that he never would desert the fortune which had hitherto befriended him. On the morning of the day fixed for his destination, he had gone to the Louvre, surrounded by forty of his favourites or dependants; and was attentively employed in reading a letter, when the captain of the guard, and a few friends whom he had associated with him in the enterprise, made their appearance. The attendants of D'Ancre, supposing that the king was approaching, gave way; and the captain of the guards advancing, arrested him in the name of the king. Astonished, and suspecting treachery, he laid his hand on his sword. This mark of his resistance was the signal for his destruction: three pistols were instantly fired at him, and he fell lifeless on the ground. As the king was at a window where he could see what was going on, his presence prevented the adherents of D'Ancre from rising in their master's behalf. His son and his wife were immediately arrested. The latter, instead of being tried for her real crimes, though they were sufficiently notorious, was principally accused of sorcery and magic. The judge having demanded what charm she made use of for the purpose of fascinating the queen, she replied, nobly and truly, "The ascendant which a superior genius always has over a weak mind." She was condemned, and suffered the severest tortures.

And herself disgraced.

The disgrace of the Queen-mother followed the destruction of her favourites. Licenes succeeded to the honours and situations of D'Ancre; the captain of the guards was raised to the rank of marshal; and the Bishop of Lucon was compelled to resign the seals of secretary of state. The submission of the Dukes of Mayence, Vendome, Nevers, and Rohan, were among the first consequences of the fall of the Italian favourites. Licenes now turned his attention to the best means of securing the permanency of his high situation, and of ennobling his obscure birth by an illustrious alliance. At first, he aspired to the sister of the Duke of Vendome, the natural daughter of Henry IV.; but he afterwards judged it more prudent to lower his views to the daughter of the Duke of Montbazon, who with pleasure received as his son-in-law the favourite of the king. Still, however, further measures were necessary, to make the nobility and people forget that one favourite had only been destroyed to make room for another. Licenes, therefore, who had been created Duke, assembled the states of Rouen in the year 1618, and abolished the most burdensome imposts: he also appeared zealous to procure the freedom of the Prince of Condé, in order to secure the favour of the princes of the blood. By these proceedings, and by the appointment of the Duke of Mayence to the government of Guienne, and the Marshal Ornano to that of Normandy, he succeeded, in a great measure, in accomplishing his object. The government of the Isle of France he reserved to himself, as allowing him, at the same time, to attend to his interest at court.

Enters into a plot with the Duke of Epernon.

The Queen-mother, however, was still formidable, even in her exile at Blois: and Licenes, consequently, could not deem himself perfectly secure. She entered into a plot with the Duke of Epernon, who suddenly quitting Metz at the head of 100 horse, and advancing to Blois, succeeded in rescuing Mary from her captivity, and immediately conveyed her into Angouleme, at the very time when Licenes had persuaded Louis to commit her a close prisoner to the castle of Amboise. The king at first was highly enraged, and resolved to recover her mother by force of arms; but Licenes, apprehensive that such a proceeding would excite universal disgust and dissatisfaction, had the prudence to oppose this resolution. The Duke of Epernon and Mary, on their part, were sincerely desirous of a reconciliation with the king. In order to effect this, Licenes recalled the Bishop of Lucon, and by his influence tranquillity was again established. The Queen-mother was restored to liberty, and in lieu of the government of Normandy, she received that of Anjou: her adherents were reinstated in their offices; but the Bishop himself, who had been so instrumental in bringing about this wished-for reconciliation, concealing his passion for power till a more favourable opportunity, at present displayed the appearance of an honourable disinterestedness, and refused to accept of any situation.

Louis's measures against the Protestants, A. D. 161

From the beginning of the reign of Louis, the Protestants had been treated in such a manner, as justly rendered them apprehensive that the privileges granted them by Henry IV. would be infringed. In 1617, the King gave them great offence by an arret of council, ordering the restitution of the church lands in the district of Bearn, which the Protestants in that province had enjoyed above 60 years. Upon this a meeting was held at Rochelle, and they resolved to erect a republic on the model of the Dutch. About the same period, the people at large began to murmur at the imposition of new taxes; and the nobility were displeased at the increasing fondness of the king for his favourite the Duke of Licenes. The Duke of Mayence retired to his government of Guienne; the Count of Soissons, the Dukes of Vendome, Nevers, Rohan, and Rets, repaired to Angers, where the Queen-mother resided, who had already begun to intrigue again. The Duke of Epernon also declared in her favour; so that she found herself in a condition to assume a lofty and decided tone, and to declare that she never would consent to any future treaty, unless it were guaranteed by the Parliament of France, or by some foreign power. The King's character for indecision and weakness, on this occasion, had induced the Queen-mother and her adherents to pass all bounds of decency: But, to their surprise and terror, he acted with vigour, activity, and firmness: assembling his forces as rapidly as possible, he went into Normandy, where he reduced Caen, and prevented Rouen from joining the rebels. Mary on this took the alarm; and the Bishop of Lucon, in whom she still placed the greatest confidence, persuading her to try the effects of a new negociation, she deserted her party, and a new treaty, which confirmed the former, was signed. The Bishop of Lucon, on this occa-

He offends the nobility

sion, threw off the mask which had so long concealed his aspiring and ambitious projects; and entered into an agreement with the Duke of Licenes, to bestow the hand of his niece on his nephew, on condition that the Duke should use his influence to raise him to the rank of Cardinal.

War against the Protestants.

Licenes having thus succeeded in enlisting on his side the great and useful talents of Richelieu, turned his thoughts towards the reduction or the conversion of the Protestants; and resolved, for this purpose, immediately to have recourse to arms, while, at the same time, he did not neglect every art of intrigue. The Protestants were apprised of their danger; and scarcely needed the exhortations of the Duke of Rohan, son-in-law to the Duke of Sully, and of his brother the Duke of Soubese, to induce them to resolve on defending their religious liberties at the hazard of their lives. They were, however, deprived of the talents of Du Plessis Mornai, who, in the reign of Henry, had distinguished himself by his ardour in the cause of Calvinism; for he now declared that he could not conscientiously oppose his sovereign, and from this conviction he surrendered the castle of Saumur, which commanded the passage of the Loire. The Dukes of Bouillen and Tremouelle followed his example The first enterprise of the royal army, commanded by the king in person, was the reduction of St Jean d'Angeli; this place was gallantly, though ineffectually, defended, for 35 days, by the Duke of Soubese; and, on its surrender. Louis had the magnanimity, as well as the policy, to permit the garrison to depart unmolested.

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From this place, in 1621, the army proceeded to Montauban, into which the Protestants had thrown a numerous garrison commanded by the Marquis de la Force. The royal army consisted of 25,000 men; but the place was so gallantly defended, that Louis, in spite of their most vigorous efforts, was obliged to abandon the enterprise. Licenes died soon after this shameful expedition; and Lesdeguiers, who had already deserted the Protestants, was, on solemnly renouncing Calvinism, honoured with the Constable's sword; while the Cardinal de Retz succeeded to the presidentship of the council, in conjunction with the Count of Schomberg. The advice of his new ministers was equally hostile with that of his old to the cause of the Protestants. The Duke of Soubese, after the reduction of St Jean D'Angeli, had put himself at the head of a desperate band, and ravaged the country. On the approach of the royal army, he retired into the isle of Rhe, separated from the continent by a small arm of the sea, which was fordable at low water: this arm Louis crossed in the night, and stormed the entrenchments of the Duke, who succeeded in escaping by swimming to the main land. Negrepelesse was also taken by storm; and all the inhabitants, without regard to age or sex, were put to the sword. This cruelty however, only filled the breasts of the Protestants with deeper indignation, and roused their courage to a higher degree of enthusiasm. The Duke of Rohan commanded in Montpellier, and prepared to offer a most formidable resistance; hither the Prince of Condé marched with a numerous and well-appointed army; but Montpellier was defended as gallantly as Montauban had been, and the prince beheld the flower of his army consumed in ineffectual assaults. Rochelle also, though invested by sea and land, still held out; and Louis, to prevent a second disgrace, listened to the advice of the Constable, and consented to a treaty with the Protestants in 1622. The edict of Nantes was again confirmed; the royal forces were withdrawn from the gates and harbour of Rochelle; and the inhabitants of Montpellier agreed to surrender to their sovereign.

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Projects of Cardinal Richelieu.

The Cardinal of Retz dying about this time, Cardinal Richelieu, by the influence of the queen, was introduced into the royal councils: scarcely had he got a share in the administration, (which in a short time he entirely governed,) before he formed three mighty projects; to subdue the turbulent spirit of the French nobility; to reduce the rebellious Protestants; and to curb the encroachments of the House of Austria. But it was, in the first place, necessary to remove his rivals in the cabinet; the care of the finances, therefore, about which he was most anxious for the prosecution of his designs, was taken from the Duke of Vienville, and given to Morillac, a man upon whose subserviency be could completely depend: other changes of a less important nature were also made. His next project, before he entered on the execution of his grand designs, was the expulsion of the Pope from the Valteline, which he accomplished, regardless of the remonstrances of Gregory XV. These, however, were only preliminary steps, or rather intended as indications of the extent of his ambition and of his means; but in order to put his grand designs in execution, it was necessary to preserve peace with England. James I. at this time sat on the throne of that kingdom, and had determined not to bestow the hand of his son Charles, except on a Princess of France or Spain. Richelieu, aware of this, negociated, in spite of the courts of Rome and Madrid, a treaty of marriage between the Prince of Wales and Henrietta of France, sister of Louis XIII.

He now turned his abilities to the destruction of the Protestants. As the last treaty had been violated in several respects by the court, they were preparing for renewed hostilities, when a new subject of discontent arose. A royal fleet was stationed at L'Orient, to block up the harbour of Rochelle. This the Duke of Soubese offered to attack; and if he failed, the Protestants were to disown his conduct. He succeeded, and his brother the Duke of Rohan immediately displayed the standard of revolt. A sharp but desultory war was carried on, which was terminated for the present by the mediation of the Queen of England; the edict of Nantes was again confirmed; the harbour of Rochelle freed from blockade; and the King of France agreed that the King of England should guarantee to the Protestants the articles of the peace.

Cabals against him.

A powerful faction now rose at court against Richelieu Not one prince of the blood was sincerely his friend. Gaston, the Duke of Orleans, the King's brother, was his declared enemy. The Queen-mother herself was become jealous of him; and even the King was attached to him rather through fear than affection. But the intrigues of the courtiers, thus supported and encouraged, could not escape the vigilance of the Cardinal: he discovered and dissipated all their conspiracies, and at last made himself absolute master of the King and kingdom.

During these cabals, the Protestants, complaining that the terms of the last treaty had not been strictly complied with, displayed a disposition once more to render themselves independent; and in this they were confirmed by the assurances of support which they received from England, where a fleet of 100 sail, and an army of 7000 men, were fitted out for the invasion of France. These preparations, however, were entrusted

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to a man by no means fit for the enterprise, the Duke of Buckingham, whose measures were so ill concerted, that the inhabitants of Rochelle, when he appeared before their harbour, refused to admit his troops. They were but a part of the Protestant body, they observed, and they must consult their brethren before they gave admittance to an army, of whose coming they had not been previously informed. The Duke next directed his force against the isle of Rhe, which was well garrisoned and fortified, instead of attacking Oleron, a fertile and defenceless island. He did indeed succeed in effecting a landing in Rhe, but he left behind him the small fort of Prie, which covered the landing place; allowed Thorias the governor to amuse him with a deceitful negociation, till St Martin, the principal fort, was provided for a siege; and then attacked it before he had made any breach, and thus threw away the lives of his soldiers. He likewise guarded the sea in such a negligent manner, that a French army got over in small divisions, and obliged him to retreat to his ships.

Siege of Rochelle.

The Protestants were now at the mercy of Richelieu, who had already, by separate treaties, secured the alliance of Spain, and of the United Provinces. The army he assembled was commanded by the King in person, attended by all the principal nobility. The Cardinal himself, aspiring to the reputation of a general, planned the lines of circumvallation, designed the forts, and directed the attack. The citizens of Rochelle, animated by civil and religious zeal, and abundantly provided with military stores, resolved to defend themselves to the last extremity; and their Mayor, Guyton, a man of experience and fortitude, took the command, as neither the Duke of Rohan, nor his brother Soubese, were in the place. The Cardinal, finding it impossible to reduce it so long as the communication by sea remained open, attempted first to shut up the harbour by stakes and by a boom; but these methods being ineffectual, he recollected what Alexander had performed at the siege of Tyre, and erected a mole a mile in length across a gulf, into which the sea rushed with great impetuosity. The inhabitants, before it was completed, saw an English fleet approach; they crowded the ramparts in the expectation of relief; but the English Admiral, after throwing in a small supply of corn, either through cowardice or treachery, declined an engagement with the fleet of France, and returned to Portsmouth. The Duke of Buckingham then resolved to resume the command; but while he was hastening the preparations, he was stabbed by Felton. In the mean time the mole was completed, and so strong as to resist all the attacks of the Earl of Lindsay, who succeeded to the command of the English fleet. He was obliged to abandon the enterprize; and as the sails of his squadron vanished from the view of the abandoned and despairing inhabitants, they consented to surrender, after a siege of 12 months. They were deprived of their privileges, and their fortifications were destroyed; but they were permitted to retain possession of their property, and allowed the free exercise of their religion, A. D. 1629. Scarcely had the inhabitants opened their gates, when a tempest arose so violent as to bury in the ocean that mole which had been the cause of their ruin; so that, if they had held out only a few hours longer, the pride of the Cardinal would have been humbled, and their freedom preserved.

Surrenders, A. D. 1629.

Richelieu, deeply impressed with the advantages that result from quickly following up success, immediately after the fall of Rochelle marched into the other parts of France, where the Protestant party were powerful, or possessed the cautionary towns. He met with the most vigorous resistance in Languedoc from the Duke of Rohan, who, however, when he learnt that England had concluded a peace with France, and thus abandoned the Protestants to their fate, had recourse to negociation, and obtained very favourable conditions both for himself and his party. The Protestants were permitted to retain their estates, and allowed the free exercise of their religion; all the privileges of the edict of Nantes were also confirmed to them; but they were deprived of their cautionary towns, as dangerous to the state. From this period is justly dated the aggrandizement of the French monarchy, which had suffered considerable diminution by the power that the Protestants had acquired during the civil wars. Indeed, it seems to have been Richelieu's object, not so much to subdue the Protestants, because they were of a different religion from that established in France, as because they had erected themselves into an independant community, and aimed at an entire separation from the monarchy. It was in their political, not in their religious character, that he chiefly regarded them as enemies to his plans of aggrandising the power of the sovereign; and that this was his view of them, will further appear in the sequel, when we advert to the assistance which he gave to the Protestants in Germany.

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The Protestants finally reduced.

As Richelieu had displayed an extent and variety of talent, during the siege of Rochelle, which he was not previously supposed to possess, the King determined to commit to his superintendence the care of the marine; and for this purpose he persuaded the Duke of Montmorency to resign that situation. This department soon experienced the beneficial effects of the comprehension of the Cardinal's mind, and the activity and vigilance of his management. But he did not confine himself to this or any other particular branch of public business. Indeed, the care of these were only subordinate to his grand and daring designs; for, having subdued the Protestants, he now directed his thoughts to the humbling of the house of Austria. This he perceived could be done most effectually, and at the same time with the least risk to France, by supporting the Protestants in Germany. There were, however, other means, of a less extensive nature, which he did not neglect.

Richelieu's plans to humble the Austria

On the death of the Duke of Mantua, the Duke of Nevers claimed the duchy, as the next male heir; but the Emperor thought proper to bestow it on the Duke of Guastalla; and the Duke of Savoy again urged his pretensions to the dependent marquisate of Montserrat. Both were supported by Philip, King of Spain. The Duke of Nevers, in his distress, knew not where to turn for assistance. He had incurred the suspicion of the Cardinal, by uniting with his secret enemies in France. He was the object of dislike to the Queen-mother; but Richelieu possessed so much patriotism, that he abandoned the sense of his own injuries, refused to listen to the complaints of Mary de Medicis, and strongly advised the King to support the Duke against the House of Austria. An army was accordingly formed: Louis placed himself at their head. The Alps were passed; the narrow pass of Susa penetrated; and the Duke of Savoy, alarmed, and unequal to the combat, was under the necessity of deserting his allies, and of uniting his troops with those of France. Casal was at that time besieged by the Spaniards; and when Louis first entered Italy, he meant to have advanced with his whole army to its relief; but, upon learning that the

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Duke of Rohan had again roused the Protestants in several provinces, he himself returned with most of his troops, leaving 3000 chosen soldiers for the protection of Casal. The Protestants were soon reduced. In the mean time, the Duke of Savoy, violating his engagements, had joined the Spaniards in the siege of Casal; upon which the Cardinal, lately appointed lieutenant-general, and thus possessed of all military and civil power, prepared to reduce him to submission. In a short time, his troops approached Turin; but while the Duke was preparing for the defence of his capital, Richelieu suddenly changed his direction, marched against Pignerol, an important fortress, which opened a direct passage from Dauphiné to Italy, and took it in 12 days. Louis now joined the army; and, in a short time, reduced the whole of Savoy; which so afflicted the Duke, that it caused his death. This circumstance facilitated the progress of the French; but their career was stopt by a pestilential disorder, that carried off great numbers, and enfeebled the bodies and minds of most of the survivors. Notwithstanding this calamity, they were ordered to proceed to the relief of Casal, when the treaty of Ratisbon was concluded, which established the Duke of Nevers in the peaceable possession of the duchy of Mantua, and the marquisate of Montserrat.

ite with stavus lolphus.

The designs of the Cardinal against the House of Austria were now ripe for execution. The Emperor and the Protestant princes of Germany were at war: the famous Gustavus Adolphus of Sweden embraced their cause; and Richelieu, regarding this as an excellent opportunity of humbling Austria, agreed to pay Gustavus an annual subsidy of 1,200,000 livres; in consideration of which, the King of Sweden was to maintain in Germany an army of 36,000 men; to observe a strict neutrality towards the Duke of Bavaria, and all the Princes of the Catholic League, provided they did not join the Emperor; and to respect the rights of the Roman Catholic church, wherever he should find it established. Thus Richelieu avoided giving alarm or offence to the Catholics, while he furnished the princes of that persuasion with a sufficient reason for not joining the Emperor, since thus they would be exposed to the hostility of Sweden.

While the war was carrying on in Germany, the Cardinal was employed in France in crushing the conspiracies which were formed against him, at the instigation of the Duke of Orleans and the Queen-mother. His vigilance and activity were so great, that his enemies had no chance against him. Mary de Medicis was banished the kingdom; her son Gaston was obliged to beg his life; the Marshals Morillac and Montmorency were brought to the block; and the most arbitrary sentences were daily passed, in a court erected for the trial of his enemies.

Hitherto France had not engaged in open hostilities with Austria, though, if she had, it is probable the design of Richelieu, of humbling that power, would have been more successful than it proved to be; but jealous of Gustavus, or the necessity of keeping a large force in France to awe the discontented, prevented him from acting in an open and decided manner, till the death of the Swedish monarch rendered his efforts unavailing. It is also known that Oxenstein,[1] the minister of Gustavus, was unwilling at first to give the French any footing in Germany. After the unfortunate battle of Nordlingen, however, Oxenstein put Louis in possession of Philipsburgh and Alsace, on condition that France should take an active part in the war against the Emperor. Richelieu also concluded an alliance with the United Provinces, in the hope of gaining part of the Low Countries; and he denounced war against Spain. A treaty was at the same time entered into with the Duke of Savoy, in order to strengthen the French interest in Italy.

Immense preparations of France.

In a short time, the activity of Richelieu had prepared five armies for active service. The first and largest was sent into the Low Countries, under the command of the Marshals de Chatillon and Bregè; the second, under the command of the Duke de la Force, entered Lorraine; the third, under the Marshal de Crequi, entered Milan; the fourth was led into the Valteline by the Duke of Rohan; and the fifth, under the Duke of Saxe Weimar, acted on the Rhine. But these immense armies performed scarcely any thing corresponding to their magnitude, or to the hopes and designs of Richelieu: indeed, they were too great for the finances of France to support. The Cardinal's household alone, which was more splendid than the King's, swallowed up four millions a year. There was no resource but in the wretched expedient of money-edicts; and these were accumulated so rapidly, and to such a degree, that at one sitting, the parliament were obliged to register 42 of them, without examining, or even reading them. The consequences were such as might be anticipated: the armies in Flanders and Germany mouldered away for want of provisions. The first campaign was everywhere unsuccessful, except in the Valteline, where the Duke of Rohan maintained himself with a few troops, against the Germans and Spaniards, while the Marshal de Crequi, though assisted by the Dukes of Savoy and Parma, could make no progress in Italy. Richelieu, in order to raise so many armies, was obliged to expose France, on the side of Picardy, to the incursions of the allies. The Spanish army commanded by Prince Thomas of Savoy and the celebrated Piccolomini, entered this province—passed the Somme—made themselves masters of Corbie—and spread terror into the capital. Richelieu, under these calamities, remained cool and unshaken, and put forth all his vigour and activity. His own guards were dismissed; the horses and domestics of the wealthy, and the personal services of the poor, were put in requisition; and, in a short time, 50,000 men were assembled for the defence of Paris. The command of these was divided between the Duke of Orleans and the Count de Soissons, who compelled the enemy to repass the Somme, and retook Corbie. In the mean time, the Spaniards ravaged Burgundy, and invaded Guienne, but they reaped no advantage from these successes.

Plan to assassinate the Cardinal.

Still, however, France had suffered considerably by the war in which she had engaged; and as Richelieu was known to be the adviser of it, his unpopularity increased. The Duke of Orleans and the Count de Soissons, as soon as they had freed their country from the Spaniards, formed a plot to assassinate him in the King's apartment; and the blow would have been struck, had not the resolution of the Duke forsook him at the very moment when the conspirators expected the signal for the assassination. Scarcely, however, had the Cardinal thus narrowly escaped, when he was exposed to danger from a quarter where he least dreaded it. Father Caussin, a Jesuit, confessor to the King, employed the influence and opportunities which his character gave him, to exasperate the mind of Louis, by representing the Cardinal as the oppressor of the Queen-mother, the tyrant of the kingdom, and, above all, the support of heretics: but this scheme was soon discovered, and ended in the banishment of the Confessor.

The war still continued, notwithstanding the Pope endeavoured to bring about a reconciliation. The Duke of Rohan, not being properly supported, lost the Valteline. On the other hand, the Count D'Harcourt recovered the isles of St Margaret and St Honorat, on the coast of Provence, which had been taken by the Spaniards in 1635; the Duke of Valette reduced several forts, which the Spaniards had seized in Guienne; Marshal Schomberg raised the siege of Lucat, and defeated Serbillon, the Spanish general; Cardinal de La Valette reduced Capelle again under the dominion of France; the Marshal de Chatillon obtained possession of Damvilliers in Luxemburgh; and the Duke of Longueville successfully advanced in Franche Comté. The Marshal Crequi, aided by the Duke of Savoy, defeated the Spaniards in Italy, under the command of the Duke of Modena; while Breda was obliged to surrender to the Prince of Orange.

Success of the French in the Brisgaw. A. D. 1637.

In 1637, Ferdinand II. died, and was succeeded in the imperial throne by Ferdinand III. who pursued the same line of politics as his father: hostilities therefore were continued. In the following year, the Duke of Saxe-Weimar, supplied from the treasures of France, took the field again; but he was surprised and routed in the siege of Rheinfeld, where the Duke of Rohan, who served as a volunteer, from a friendship to the Duke of Saxe-Weimar, was mortally wounded. The latter, impatient to wipe off the disgrace of his defeat, collected all his force, and exerted all his talents and skill; and soon conquered in his turn. General de Savelli, and the famous John de Wert, who led the Imperialists, were taken prisoners; and the towns of Rheinfeld and Fribourg, the capital of the Brisgaw, were reduced. The siege of Brisac was afterwards undertaken with the greatest confidence of success; during which, the Duke of Lorraine, and the Imperial General Goentz, attempted in vain to check the success of the Duke of Saxe-Weimar; and Brisac was forced to surrender, after it had been reduced to such an extremity that the governor was under the necessity of setting a guard on the burial-places, lest the inhabitants should dig up and devour the dead.

As soon as Richelieu heard of the reduction of Brisac, he immediately formed the scheme of annexing it to France; and accordingly made the proposal to the Duke of Saxe-Weimar. But this general would not part with his conquest: "To part with my conquest," was his reply, "would be to sacrifice my honour: ask a virgin to give up her chastity!" In 1639, the Duke died, not without suspicion that his death had been hastened by the Cardinal, who certainly, as soon as it happened, succeeded in procuring from his successor, not only Brisac, but Fribourg also. Thus was the King of France, by the abilities and intrigues of his minister, rendered sovereign of almost all Alsace, and a great part of the Brisgaw.

To retaliate on the Spaniards for their invasion of Picardy, the Prince of Condé was ordered to lay siege to Fonterabia; but he was defeated by the Admiral of Castile, and with the remainder of his army, escaped with difficulty to his ships.

Attempt on Ratisbon. A. D. 1641.

In 1641, the Emperor, though he pretended to be desirous of peace, convoked a diet at Ratisbon, for the purpose of concerting measures for carrying on the war. Upon this the Swedish general Bannier, having joined the French army at Erfurt, formed the design of dispersing the assembly, and even of surprising the city. His march was rapid and well planned. He arrived at Hoff on the 5th of January, and proceeding with the same celerity, he crossed the Danube on the ice, and took above 1500 of the enemy's cavalry. The Emperor himself narrowly escaped being made prisoner. As Ratisbon was utterly unprepared for a siege, the approach of the Swedes and French created great alarm; They had planned to take advantage of the frost, and starve the town into submission; but the weather changing, it was resolved to repass the Danube, before the ice thawed. Bannier, however, ordered the general of the French troops to advance as nearly as possible to Ratisbon, and to salute the Emperor with 500 shot; an insult which nearly deprived Ferdinand of all the powers of reason and recollection. After this ineffectual attempt, the French separated themselves from their allies, and marched towards Bamberg. After the death of Bannier, they again united, and under the command of Guebriant, defeated the imperial army, led by the Archduke and Piccolomini, at the battle of Wolfenbuttel. As soon as Tortensten assumed the command of the Swedes, the French again separated from them, by order of the Cardinal, and Guebriant entered Westphalia.

In the mean time, a new treaty was concluded between Sweden and France, and the most vigorous resolutions taken for prosecuting the war. Guebriant crossed the Rhine, and understanding that Hasfeld was on his march to join Lamboy, another Imperial general, he resolved to attack the latter in his entrenchments before their junction. After an obstinate struggle, the Austrian infantry were broken, the camp forced, Lamboy made prisoner, and of the whole Imperial army not above 500 escaped. The consequence of this victory was the reduction of nearly the whole electorate of Cologne by the French. Their allies the Swedes were equally successful in Germany; so that the Imperial court was filled with consternation.

Conspiracy against Richelieu. A. D. 1642.

On the side of Spain, a French army entered Rousillon, and reduced Colonna and Perpignan. Louis himself was at the head of this army, by the advice of Richelieu, who accompanied him as far as Narbonne, where he fell dangerously ill. During his illness, a confederacy was formed against him, at the head of which was Cinq Mars, whose lively temper, agreeable address, and handsome person, seconded by the recommendation of the Cardinal, had made him a great favourite with the king. Thus fortunate, he aspired to be made a Duke; and on the Cardinal opposing his wishes, he became his secret enemy. Cinq Mars was a man of very weak intellect, and it is probable that his intrigues would have been immediately frustrated by his incapacity, had he not been counselled by the son of the celebrated historian De Thou, by whose advice he connected himself with the Dukes of Orleans and Bouillon, and soon afterwards formed a secret alliance with the court of Spain, which promised to supply the conspirators with money and a formidable army. But Richelieu's system of vigilance and detection was so well organised, that, even during his extreme illness, it operated as powerfully and completely, as if he had been able to superintend it himself. He was informed of the plot long before it had assumed a dangerous aspect; and he immediately persuaded Louis to return to France, even before the fall of Perpignan, putting into his hands a copy of the treaty which the conspirators had entered into with Spain. Cinq Mars was arrested in Narbonne, and the Duke of Bouillon in Italy, where he had the command of the French army. The proceedings against the conspirators were carried on at Lyons, under the eyes of the minister. Additional proof was necessary to condemn them; the Duke of Orleans was mean and base enough to furnish it, in order to save his own life. The Duke of Bouillon purchased his pardon, by giving up the principality of Sedan; but Cinq Mars and De Thou were condemned to death, and executed in 1642. Almost immediately after the execution, the Cardinal having received intelligence of the fall of Perpignan, wrote to the king, "Sire, your enemies are dead, and your troops are in Perpignan." It is said that Louis looking on his watch, about the time when Cinq Mars was to suffer, said, "Within an hour, the great man will pass his time very disagreeably."

His death.

Richelieu having thus triumphed over his enemies, at the very moment when he was himself approaching the grave, returned to Paris; and as he was obliged to be carried in a litter, a breach was made in the walls of that city to allow it to enter. He survived a very few days. On his death-bed, he protested to Louis, that his counsels had ever been directed to the honour of the crown, and the welfare of the kingdom. The character of the statesman must have sufficiently appeared from his actions. His plans were undoubtedly comprehensive and profound, and in the execution of them he displayed wonderful vigour; but he was stained with the vices of ambition, hypocrisy, cruelty, pride, and avarice. The Emperor Peter the Great of Russia, however, considered him as such a complete statesman, that on his visit to France in 1717, he is said, on viewing the monument of Richelieu, in the church of the Sorbonne, to have exclaimed, "Oh, great man, if you had been alive now, I would have cheerfully given you the half of my empire, if you would have taught me how to govern the other half!" Mary de Medicis died soon afterwards in exile and poverty at Cologne.

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Some time before his death, Richelieu had obtained a cardinal's hat for Mazarine, and had introduced him into the king's council. It was therefore supposed that he would succeed his patron as prime minister; but Louis resolved to govern himself. The servants of the crown were retained in their situations; and the only change which marked the death of the Cardinal, was the recalling from banishment, and releasing from confinement, the principal objects of the Cardinal's resentment and jealousy. The war was prosecuted with diligence and vigour; though the Swedes, who were at first doubtful of the politics of Louis after the death of the Cardinal, had begun to think of concluding a separate treaty with the Emperor. Mazarine was not, indeed, possessed of the situation, or the influence of the Cardinal; but he had sufficient power over the King to persuade him (to what indeed he was by no means indisposed) to pursue the line of politics marked out by that statesman. All the operations of war were concerted with the same judgment as formerly: supplies of every kind were furnished with equal punctuality. In Germany, Guebriant, in conjunction with the Swedes, triumphed over the Imperialists; while, in Piedmont, Lorraine, Roussillon, and Catalonia, Schomberg, L'Hospital, and two other French generals, were equally successful.

Arrangements of Louis on the approach of his latter end.

Louis, in the midst of these successes, was fast approaching his latter end; and, as the tender years of his son would expose the kingdom to dissensions, unless a wise and vigorous regency were appointed, this subject occupied his whole attention during the remainder of his days. His queen, Anne of Austria, never partook of his confidence; and the Duke of Orleans had discovered himself totally unfit for the high office, by his want of steadiness and vigour of mind; and unworthy of it by his seditious intrigues. He therefore resolved to distribute into different hands the power that he bequeathed, in order to preserve the tranquillity of the kingdom during the minority of his successor. The care of the children was entrusted to the Queen, who had also the nominal character of regent; the Duke of Orleans was appointed head of the council, and lieutenant-general of the kingdom. But these appointments were counterbalanced by others, from which Louis hoped that neither the Queen nor his brother would be able to create intrigues, or to weaken the kingdom by the incapacity or folly of their government. In case of the death of the Duke, the Prince of Condé was to fill his situation; and, after him, the Cardinal Mazarine: and it was, in fact, on the last, that Louis, by his arrangements, devolved the real management of the kingdom during the minority of his son. As a farther guard against the Duke of Orleans, the King directed that all affairs which came before the council should be decided by a majority of votes. The Queen and the Duke swore solemnly to preserve inviolate the deed which they had subscribed; and Louis, to render it still more authentic, commanded it to be registered in parliament. After these arrangements were completed, Louis lived but a very short time, expiring in the 42d year of his age, and on the very day that he had completed the 33d of his reign. This sovereign was so completely under the influence of Richelieu, that his character is not marked very decidedly by his actions: he acquired the epithet of Just; but his title to it may well be disputed, unless the severity and the cruelty of some of the public measures of his reign be entirely ascribed to his minister.

His death. A. D. 1643.

Louis XIV. was only 4½ years of age when his father died. The prospects of France during his minority were by no means of a satisfactory nature; the internal state of the country exhibited discontent and exhaustion, created by the measures of Cardinal Richelieu. The war which he had commenced with the house of Austria still continued. The Emperor Ferdinand III. less formidable than his father, struggled against the forces of Sweden and France, even though the forces of the empire, in many cases, resisted his will and his plans. Philip IV. of Spain had lost Rousillon, Catalonia, and Portugal; but he still continued the struggle against the Portuguese, the Dutch, and the French. England, though involved in civil war, was already beginning to exercise that energy which these troubles had created or brought into action, and threatened to become more formidable than ever.

His will set aside.

The will of Louis XIII. which has been noticed, was violated almost immediately after his death; his widow being invested by an arret of the parliament of Paris with continued powers. She immediately gave herself entirely up to the direction and influence of Cardinal Mazarine, who was of a subtle and insinuating character.

The Spaniards invade France.

The court of Spain, imagining that the minority of Louis afforded them an excellent opportunity of invading France, marched an army from the Low Countries into Champagne, besieged Rocroy, and spread alarm on every side; but they were mistaken, and unexpectedly were opposed by a general who, at this period, commenced that glorious career which has exalted him to the highest pitch of military fame. Previous to the death of Louis XIII. Louis of Bourbon, Duke of

First exploits of the great Condé.

Enghien, afterwards honoured with the title of the great Condé, had received the command of the French forces on the frontiers of Flanders. When the Spaniards invaded Champagne, he was scarcely twenty-one years of age; but his want of experience was amply compensated by his genius. His orders were not to risk a battle; yet, on receiving intelligence of the siege of Rocroy, he resolved to attack the besiegers. Hitherto the Spanish infantry had been deemed invincible, but in this battle, the courage of the French, directed by the talents of their young general, deprived them of that character: They were broken by his impetuous charge; the Count of Fuentes, who commanded the army, perished on the field; 9000 were killed, 20 pieces of cannon taken, Rocroi was saved, and the character of the Duke of Enghien stamped as a great general. When he heard of the death of the Spanish general, he exclaimed, "I could wish to have died like him, had I not been victorious!" Thionville, which had long been the object of Richelieu's ambition and intrigues, but from the reduction of which, by force of arms, he had been deterred by its strength, next fell before the Duke. After this he passed the Rhine, and advanced to avenge the death of Guibriant, who had fallen at the siege of Rotuil. On the death of this general, divisions and dissensions took place, of which the Imperialists took advantage, and gained the battle of Dutlingen, as well as other inferior engagements in Swabia; Fribourg also was reduced by them. The Imperialists, after the reduction of this place, had formed an entrenched camp under its walls, on hearing of the approach of the French; but the Duke was not intimidated by their formidable position, nor their superior numbers; he attacked them in their camp, and, after a battle which lasted three days, he defeated them. Philipsburgh and Mentz were the fruits of this victory; while General Merci retreated in such good order, as to prove that, at the battle of Fribourg, he had only yielded to a general of the first rate talents. In Flanders, during the years 1645, 1646, the Duke of Orleans reduced Gravelines, Mardyke, and Courtray; but the French were not so successful in Catalonia, where Philip IV. defeated the Marshal de la Motte, and took Lerida and Balaguier. In Bohemia, the Swedish general Tortensten had gained a great victory: to improve the advantages of which, Marshal Turenne was ordered to advance into the heart of Germany; but he committed an error in separating himself from his allies, and thus exposed himself to defeat. At first, indeed, he was successful; he crossed the Rhine at Brisac, and, advancing towards the sources of the Danube, routed the Imperialists. He next attempted to relieve Fribourg, which was invested by the Bavarian army, under the command of a brother of General Merci, but he was defeated. As soon as Cardinal Mazarine learned this, he ordered the Duke of Enghien to join Turenne with a reinforcement; and the two generals attacked the Count de Merci near Fribourg with such impetuosity, that he was obliged to retire with the loss of 3000 men. This battle, which lasted seven hours, was immediately followed by another, in which the Bavarians at first were successful, but the Duke rallied his troops, and drove the enemy three times from their entrenchments, which they as often regained, till at last Merci, having lost nearly one-half of his army, resolved to retreat. This he effected in good order, notwithstanding all the attempts of the French to harass him, leaving behind all their artillery and baggage. The consequences of this victory, were the reduction of all the towns situated between the Rhine and the Moselle, from Mentz to Landau.

War in Flanders, Catalonia, and Germany. A. D. 1645, 1646.

After this, Turenne established his winter quarters at Marendahl, his troops being dispersed in the neighbouring villages. As soon as General Merci learned this, he marched rapidly against him, and gained a partial victory. The Duke of Enghien was again sent by the Cardinal to reinforce Turenne; and the two generals resolved to bring the Bavarians to a general action. With this view, Turenne, whose day it was to command, advanced at the head of his cavalry; but the position of the enemy was so strong, that it was not deemed safe to attack them. As soon, however, as the command fell to the Duke, he resolved to march to the Danube, and had got as far as Nordlingen when the Bavarians came up with him. He immediately arranged his army in order of battle, on the very same plain where the Swedes had suffered a defeat soon after the death of Gustavus. The Bavarians were drawn up on an eminence of easy ascent. The action was begun by the French, who at first gave way, and suffered a great loss; nor could their utmost efforts turn the tide of battle, till De Merci was slain at the head of his conquering troops. Even after his death, the Duke would not have been able to have preserved his troops from destruction, had not Turenne attacked the right wing of the enemy, when a terrible conflict ensued, in which the first line of the Bavarians was broken; but the second advancing, the French were ready to give way when the Duke came up; and the Bavarians were obliged to retire, leaving behind them their cannon. Turenne now charged them in flank, and their route was complete. This obstinate and well-contested battle produced few favourable consequences to the victors; for though Nordlingen and some other places were reduced, they were soon recovered by the Bavarians, on their receiving a strong reinforcement. The Duke of Enghien returned to Paris; and Marshal Turenne had the honour of closing the campaign by re-establishing the Elector of Treves in his dominions.

Battle of Nordlingen.

A. D. 164

In 1647, the Duke of Enghien succeeded to the title of Prince of Condé, by the death of his father. At this time, he seems to have excited the jealousy of Mazarine; for he was sent, with an inferior army, very ill equipped, into Catalonia, to effect the reduction of Lerida. The preceding year this place had been besieged by Count D'Harcourt, viceroy of Catalonia; who had suffered himself to be surprised by the Spanish general, in a manner that incurred the displeasure of Mazarine, and induced him to resign his command. The Prince of Condé, on his arrival, found the lines of the Count D'Harcourt so little damaged, that he easily repaired them, and the trenches were opened with a flourish of violins. The city was defended by the governor with very great skill and courage: he harassed the besiegers with continual sallies, and disputed every inch of ground. In the mean time, the French found unexpected difficulties in forming their mines, by the intervention of a rock: the troops were diminished by fatigue; the season was unfavourable for labour, and prejudicial to health, on account of its extreme heat; the Spanish army advanced to the relief of the place, and the Prince of Condé was obliged to raise the siege.

Hitherto the negociations at Munster and Osnaburgh had varied according to the fortune of war; but the French and Swedes being now decidedly victorious, the Emperor, deserted by his allies, was obliged to receive the law from these powers; and consented to purchase peace, by ceding to France the bishoprics of Metz, Toul, and Verdun, and giving up his pretensions to Pigneral, Brisac, and Alsace. This was the memorable peace of Westphalia, signed at Munster, on the 24th day of October 1648, which, till the French Revolution, was considered as a fundamental law of the empire, and the basis of all subsequent treaties.

Peace of Westphalia. A. D. 1648.

France, however, was still at war with the Spanish branch of the House of Austria; and as the United Provinces, jealous of the former power, had concluded a separate treaty with Philip in 1647, the Cardinal found it necessary to exert all his talents at this crisis, especially as his influence was now seriously threatened by intestine disorders.

In 1648, the Prince of Condé resumed the command in Flanders, where he reduced Ypres. He was opposed by the Archduke Leopold, who, to balance this acquisition, took Courtray and Furnes, and advanced to the siege of Lens. This place the prince resolved to relieve if possible, but he had the mortification of beholding it surrender. Still he was determined to engage the enemy: immediately before the battle, he addressed his soldiers in few but emphatic words: "Remember, my friends, Rocroy, Fribourg, and Nordlingen." The Spaniards, though superior, were defeated: 5000 were killed; 3000 made prisoners; and the Archduke himself escaped with difficulty.

sturb- ces in ance.

The civil war in France now calls for our attention. The overthrow of Mazarine was the object of it: he was objectionable to the French on many accounts; in the first place he was a foreigner, and an Italian; in the next place, though he had not the pomp and haughtiness of Richelieu, his fortune, his power, and the necessities of the nation, furnished matter of complaint and discontent. The finances, which had been placed on such an excellent footing by the Duke of Sully, who had, moreover, rendered their collection and management so very simple and easy, that moderate talents and attention, joined to economy, might have kept them so, were in a very dilapidated state. Seventy-five millions, the amount of the revenue, were not sufficient for the expenditure; and yet the armies were not numerous; the superintendance of the finances had been given to an obscure and rapacious Italian, who had recourse to money edicts. The money due to the magistrates was not paid; some quarters of the annuities were retrenched; murmurs broke out; the parliament opposed the court; and a civil war was on the point of being kindled. An arret of union between the courts of Paris gave the minister uneasiness, and was annulled by the council. The magistrates maintained that their union could not be regarded as unlawful, or reprehensible; upon which Mazarine replied, "The king must be obeyed; if he forbid wearing tassels to band strings, it is less the nature of the thing prohibited, than the prohibition, which constitutes the crime." The parliament abolished the situation of intendants of the provinces who were instituted by Louis XIII.; on which the court, filled with indignation, resolved to have recourse to a very bold measure. During the celebration of *Te Deum* for the victory of Lors, a president and counsellor who had distinguished themselves in the debates, were arrested by order of the Cardinal; upon which the people rose, threw chains across the streets, formed barricades, fired on the chancellor's coach, killed some soldiers, and the two prisoners were liberated.

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The coadjutor, archbishop of Paris, afterwards the celebrated Cardinal de Retz, fomented and took advantage of these disturbances: he was a man of a restless, intriguing, and seditious character; excessively profligate in his principles and manners, but possessed of very superior talents. He was jealous of Mazarine, at the same time that he despised his abilities. Thinking himself better qualified to fill the place of prime minister, he employed all his talents and his powers of intrigue to inspire the nobles with the same jealousy of Mazarine, which filled his own breast; at the same time, he inflamed the people and roused them to sedition, by representing the ignominy of submitting to the oppressive administration of a stranger. The parliament of Paris warmly seconded his pretended views of reformation; and a civil war was inevitable.

Anne of Austria.

The talents of Mazarine were by no means equal to the approaching danger; and Anne of Austria, entirely under his guidance, was nearly as unpopular as himself. She could not appear publicly in the streets without being insulted; she was continually reproached with sacrificing the good of the nation to her attachment to a foreigner; and ballads and madrigals were sung in the street, on the subject of her amours. The women took an active and zealous part at this crisis; and many of the most celebrated generals declared for or against the court, as they were ordered by their respective mistresses. In consequence of this state of things, and of their apprehension of greater danger, the queen regent, along with her children and Mazarine, left Paris, and retired to St Germains. Here, according to Voltaire, their distress was so great, that they were obliged to pawn the crown jewels in order to raise money: the king himself was often in want of common necessaries; and the pages of the chamber were dismissed, because they had not the means of maintaining them. The parliament now proceeded to extremities; they declared the Cardinal a disturber of the public peace, and an enemy to France: this was the signal of revolt: a separation of parties took place. The Frondeurs, as the rebels were called, were headed by the Prince of Conti, brother of the great Condé, and the Dukes of Beaufort, Bouillon, and Longueville. The Prince of Condé, though dissatisfied with the court, engaged in the royal cause, and joined the Queen at St Germains. But the rebels wasted their time in disputes, or vain parade, and neglected to take measures even for the defence of the capital; they were soon therefore thrown into alarm, when the Prince of Condé, at the head of 6000 troops, advanced against it. The Marshal Turenne, who had been allured by the Duchess de Longueville, sister of Condé, in vain attempted to defend Paris with an undisciplined rabble. A conference was agreed to; and a treaty concluded at Rouel, by which a general amnesty was granted, and the appearance of peace restored, without, however, any sincerity of reconciliation or extinction of hatred on either side.

Intrigues of the nobility, and fickleness of the people.

The court returned to Paris, and the Cardinal was received with joy by that very people, who, such a very short time before, had threatened his life. It is this levity of the French nation,—the absurd and contemptible mixture of a frivolous gallantry with the intrigues of state, and even with civil commotions,—and the influence exercised by the Duchess of Longueville, and other women of a libertine character, in making the most eminent leaders several times change sides, that mark out these civil wars, otherwise contemptible, as objects of interest and study to those who wish to gain a minute, profound, and intimate acquaintance with the character of the French nation.

In 1650, the Prince of Condé repeatedly insulted the Queen and the Cardinal, while, by his haughtiness, he

The *Fronde*.

Civil war.

disgusted the coadjutor who now supported Mazarine, and by whose advice the prince, together with his brother the Prince of Conti, and the Duke of Longueville, were arrested at the council table. The citizens of Paris, on this occasion, celebrated with public rejoicings the imprisonment of these men, whom they had lately hailed as their deliverers. Mazarine, however, had not gained prudence, and his triumph, of course, was of short duration. Conceiving himself secure, he affronted the Duke of Orleans, who immediately deserted the court, and became the head of the *Fronde*. On this, the parliament again took courage, and demanded the liberation of the Princes of Condé and Conti, and the Duke of Longueville; and passed sentence of perpetual banishment against the Cardinal, who went in person to liberate the princes, in the hope of gaining their favour; but they treated him with contempt. He was then obliged to flee to Liege, and afterwards to Cologne. The coadjutor this time remained faithful to the court; and by his intrigues, the Duke of Bouillon and Marshal Turenne were detached from the Fronde. In 1651, Mazarine again entered the kingdom with 6000 men, upon which Condé took up arms, and the parliament declared him guilty of high treason, though he was only going to oppose the Cardinal, against whom they had so very lately passed a sentence of perpetual banishment. Condé, in this extremity, quitted Paris, to arm in his support the provinces of Guienne, Poitou, and Anjou, and to ally himself with the Spaniards. During these convulsions, Louis XIV. being now of age, ordered the parliament to remove to Pontage, and a few of the members obeyed; but the greater part remained. Thus there were two parliaments; their resolutions, however, had now fallen into such contempt, that the rival factions disdained their mediation or support, and prepared to terminate their differences by the sword. Condé, in league with the Spaniards, appeared in the field against the king, and the Marshal Turenne supported the court.

Battle of St Antoine. A. D. 1651.

The opposing armies approached each other on the banks of the Loire, when the Prince of Condé attacked the ranks of the royal army with so much impetuosity, that they were broken. The court took the alarm; and the minister proposed to save the king by flight. This plan, however, was strongly opposed by Turenne, who, taking advantage of every inequality of ground, restored the confidence and the hopes of his party. The Prince of Condé, in the mean time, entered Paris, where he was at first received with joy; but the Cardinal of Retz, having deserted the popular cause, and succeeded in gaining an absolute sway over the Duke of Orleans, persuaded that Prince to become a candidate with the citizens for their favour, in opposition to Condé. In this he succeeded, and the Duke of Lorraine deserting the cause of the Prince at the same time, while his troops were enervated by the pleasures of the capital, Condé was not sorry to learn that the approach of Turenne presented to him the means more congenial to his talents and habits, of establishing his cause by the force of arms. In the suburbs of St Antoine, the two greatest generals of France were opposed to each other: the King from an eminence beheld the battle. The Duke of Orleans remained in his palace, undecided what part to take: Cardinal de Retz was likewise neuter, and the parliament waited the issue, before it published any decree. The citizens of Paris, afraid of both parties, or affecting to preserve a strict neutrality, shut the city gates, and would permit no ingress or egress. The combat was long and bloody: the two generals performed wonders at the head of a few men; many gallant noblemen were killed or wounded; at last the battle was decided in favour of the Prince of Condé, by the daughter of the Duke of Orleans ordering the gates to be opened for the wounded, and the cannon of the Bastile to be fired on the king's troops. Turenne was in consequence compelled to retreat. "These cannon have killed her husband," observed Mazarine, when informed of the circumstance, alluding to the hopes which the daughter of the Duke of Orleans entertained of being Queen of France.

The Duke was now declared by the Parliament lieutenant-general of the kingdom, and the Prince of Condé commander in chief of the armies of France. But the popularity of the latter was of short duration: a tumult, in which several citizens were killed, and of which he was supposed to be the author, together with his violent and haughty demeanour, disgusted and irritated the inhabitants of Paris, and he was obliged to leave that city. On the other hand, Louis, in order to appease his subjects, dismissed Mazarine, who retired to Sedan. The people, satisfied at this mark of their sovereign's attention to their wishes, of their own accord sent deputies to invite him to return to the city, which he entered amidst the acclamations of persons of all ranks. The first acts of the royal authority were the banishment of the Duke of Orleans, and the arrest and imprisonment of Cardinal de Retz. The Prince of Condé, condemned to lose his head, abandoned in France by almost all his partizans, feebly supported by the Spaniards, and pressed by Turenne, carried on an unsuccessful war on the frontiers of Champagne.

To the storms of this civil war succeeded a calm. The Parliament was humbled; and Mazarine being recalled, again resumed all his authority, and was courted by every body. Even the Parliament, that had before set a price upon his head as a public robber, now sent deputies to compliment him. The Prince of Condé, after this absurd war was finished, observed that it deserved only to be written in blank verse; and Voltaire remarks, that the name of *Petits maitres* originally applied to that prince's party, because they endeavoured to make themselves masters of the state, and now signifying overbearing and frivolous young men; and the name of *Frondeurs*, bestowed on the censurers of government, are the only vestiges remaining of these troubles.

Some parts of the kingdom were still in the power of the insurgents. Bellegarde, a town in Burgundy, was defended for the Prince of Condé, by the Count de Bouteville, afterwards known as Marshal Luxemburgh. It was attacked by the Duke of Epernon at the head of a royal army, but not surrendered till a practicable breach was made, and honourable conditions granted. In 1654, the Prince of Condé, in conjunction with the Archduke, laid siege to Arras. At the same time, Stenai was besieged by Turenne. As soon as the latter place had surrendered, the Marshal, and De la Ferte, encamped in the neighbourhood of the Spaniards, and used every stratagem to induce, or oblige them to abandon the siege of Arras, but without effect. Shortly afterwards, Turenne having been reinforced, resolved, contrary to the opinion of his principal officers, to force the Spanish lines. The Spaniards were driven out with great slaughter, and lost their baggage, artillery, and ammunition; but the Prince of Condé, with two regiments alone, after defeating a division of his opponents, covered the flight of the Spaniards, and thus saved the remains of their army. The King of Spain acknowledged and characterized his services in a short and expressive letter, "I am informed that all was lost, and that you saved all."

Turenne invades the Netherlands. A. D. 1655.

In 1655, Landreci and Quesnoy were reduced by Turenne, and thus a road was opened into the Spanish Netherlands. In the subsequent year, he invested Valenciennes with an army of 20,000 men. The lines were completed, and the operations far advanced, when the Prince of Condé, and Don John of Austria, advanced with a superior army, and in the night-time forced that part of the lines where the Marquis de la Ferte commanded. Turenne, after in vain endeavouring to restore the fortune of the battle, effected a masterly retreat, carrying off his artillery and baggage, and even halting on the approach of the enemy. In less than a month afterwards he took Capell, in sight of the Prince of Condé and Don John.

reaty with romwell.

A short time before these events, Mazarine, more anxious about the overthrow of his enemies, and the restoration of tranquillity to France, than about the preservation of that country's honour, had formed a treaty with Cromwell, by which the Protector agreed to send the Cardinal a strong reinforcement, on condition that Charles II. and his brother the Duke of York, the grandsons of Henry IV. who had sought and obtained an asylum in France, should be ordered to quit it, and that the Cardinal should deliver up to England, Mardyke, Gravelines, or Dunkirk, whichever should be first wrested from the Spaniards. Turenne, after having in vain endeavoured to make himself master of Cambray, into which, after he had encompassed it, the Prince of Condé penetrated at the head of 2000 horse, marched towards St Quintin, to meet the English auxiliaries. With these he reduced Montmede and St Vincent, raised the siege of Ardre, and concluded the campaign by taking Mardyke, which, according to the treaty, was given up to the English.

oder nkirk. 1658.

In 1658, in compliance with the urgent request of Cromwell, Turenne was ordered by Mazarine to besiege Dunkirk, while the port was blocked up by an English squadron. The Prince of Condé, and Don John, came to its release. Turenne quitted his lines to encounter the enemy; and the Prince of Condé, whose advice was not followed, anticipated the disastrous consequences, observing to the Duke of Gloucester, who was with him, that if he had never seen a battle lost, he would see one now. The English and the French charged with rival valour; the Spaniards were totally defeated with the loss of 9000 of their best soldiers, and pursued even to the gates of Furnes; but the troops under the immediate command of Condé, effected their retreat in tolerable order. Ten days afterwards Dunkirk surrendered, and Louis entered in triumph; but he was soon obliged to deliver it up to Lockhart, Cromwell's ambassador. Furnes, Dixmude, Oudenarde, Menin, Gravelines, and Ypres, also were reduced. The success of Turenne alarmed the court of Spain, and induced it to think of peace; nor was Mazarine averse to it, one of the great objects of his policy being to obtain for the House of Bourbon the eventual succession to the Spanish monarchy. With this view, he had formerly proposed peace to Philip IV. on condition that a marriage should take place between the Infanta and Louis XIV.; but as the King of Spain had at that time only one son, an unhealthy infant, the proposal was rejected, lest the Infanta, if she succeeded to the throne of Spain, should carry her right to an enemy. Now, however, as Philip had another son, he agreed to the proposal of Mazarine. A cessation of arms was immediately resolved upon; and, in order that the preliminaries of a treaty might be settled in the most satisfactory manner to each party, Mazarine, and Don Louis de Haro, met on the frontiers of both kingdoms, in the Isle of Pheasants, in the Pyrenees, A. D. 1659. Much time was consumed in disputes about precedency; but at length the conferences were begun, and, after four months, were concluded by the celebrated treaty of the Pyrenees. According to this treaty, Louis received with the Infanta a dowry of 500,000 crowns of gold; Alsace and Rousillon were confirmed to him; and he restored the duchy of Lorraine to Charles IV.; and St Omers, Ypres, Menin, and Oudenarde to the Spaniards; he also consented to pardon the Prince of Condé, and solemnly renounced all claim to any territory that might fall to him in right of his queen. The King of Spain, on his part, pardoned the rebellious Catalans; gave up Verceil to the Duke of Savoy; Reggio to the Duke of Modena; and the Duke of Newburgh, the long disputed succession to the city of Juliers, which had been sequestered by the house of Austria.

Treaty of the Pyrenees. A. D. 1660.

Death of Mazarine. A. D. 1661.

On the 9th of March 1661, a little more than a year after the treaty of the Pyrenees, Cardinal Mazarine died; and his concern for his wealth was marked, even in the last moments of his life. By a deed of gift, he resigned his riches to the king, who immediately restored the instrument. His immense wealth was soon dissipated by the prodigality of the Marquis of Meillrai, who had married his favourite daughter, or niece, Hortensia Mancini, and assumed the title of Duke of Mazarine. On the ruin of her husband, Hortensia retired to England, and subsisted on a pension allowed her by Charles the Second.

His character.

"Historians have seldom done justice to the character of Mazarine, whose political caution restrained the vigour of his spirits, and the lustre of whose genius was concealed beneath his profound dissimulation. If his schemes were less comprehensive, or his enterprises less bold than those of Richelieu, they were less extravagant. He has been accused of avarice, and seemingly with justice; yet, if we reflect, that, being an indigent foreigner himself, he married seven nieces to French noblemen of the first distinction, and left his nephew Duke of Nevers, we shall, perhaps, be inclined partly to forgive him. So many matches could not be formed without money; and the pride of raising one's family is no contemptible passion. He had the singular honour of extending the limits of the French monarchy, while France was distracted by intestine hostilities; and of twice restoring peace to the greater part of Europe, after the longest and most bloody wars it had ever known. Nor must we forget his attention to the Spanish succession, which afterwards made the house of Bourbon so formidable to its neighbours, and is a striking proof of his political foresight. His leading maxim was, that force ought never to be employed but in default of other means; and his perfect knowledge of mankind, the most essential of all mental acquisitions for a minister, enabled him often to accomplish his views without it. When absolutely necessary, we have seen him employ it with effect."

Louis himself governs.

On the death of Mazarine, the officers of state inquired of Louis, to whom they were to apply: They were surprised and disappointed, when the monarch answered, "to me." He was at this time 22 years of age; he had been ill educated, and was consequently ignorant; addicted to pleasure, and had been carefully kept at a distance from all knowledge of business by the cardinal;

Circumstances in his favour.

but he had measured his own powers of mind; and he already felt the first aspirations after that glory, which was the ruling passion of his life. He had also many circumstances in his favour, and which could not fail of impressing the minds of his subjects with loyalty, respect, admiration, and even esteem. He was remarkably handsome in his person, at the same time that there was about him a wonderful degree of majesty and dignity; these, which of themselves might have only inspired awe, were softened and tempered by affability and politeness; so that, if he was not the greatest king, he was at least, as Bolingbroke expresses it, "the best actor of majesty that ever filled a throne." His dignity of mind, and loftiness of ambition, even induced him to render his pleasures more decent than they would have been, had he been destitute of these qualities; and his court, following the example of the sovereign, was soon distinguished by its elegant gallantry. The French have always been characterised by their fondness for show, and their vanity: these he gratified in an uncommon degree, by the magnificence of his palaces, and the splendour of his public entertainments. Even his own want of literature was concealed, or forgotten, in the patronage he extended to literary men, not only in his own kingdom, but also over the rest of Europe. These qualities rendered Louis extremely popular with the great majority of his subjects; while, with the more discerning, his reign was hailed with pleasure, as soon as the measures of Colbert began to operate towards the advantage of France, and Louis, by the confidence he placed in this minister, discovered that his objects extended beyond mere pleasure or glory. Though the king in other respects had no reason to be grateful to Mazarine, who had frequently misled him, and had neglected his education, and the formation of habits necessary for his high and arduous situation; yet he had received one favour from him of great moment, when he inspired him with confidence for Colbert, one of the greatest statesmen that France has produced. Fouquet, superintendant of finances, who dissipated the public money, was disgraced and imprisoned, after a sumptuous entertainment which he gave the king at his pleasure house, that is said to have cost him 18 millions of the then current money. His successor Colbert, had only the title of comptroller general. He soon put the finances into excellent order; raised enormous sums for the public service; and created a navy, and supported a large standing army, without oppressing the people.

Instances of his haughtiness and ambition.

Two occasions soon presented themselves, on which Louis had an opportunity of displaying his vanity, haughtiness and ambition. A dispute respecting precedence, that happened between his ambassador and that of Spain, in London, furnished the first occasion: The latter at a public entry insulted the former, because he would not yield the precedence; upon which Louis threatened to commence hostilities, unless the superiority of his crown was acknowledged. Philip yielded, and dispatched Count Fuentes to Paris, with the important concession, that the ministers of Spain should no longer dispute the precedency with those of France. His treatment of the Pope was still more arrogant. The Duke of Acqui, ambassador of Louis XIV. behaved in such a haughty manner, as to be quite intolerable; and his domestics followed the example of their master. Some of them having attacked the Corsican guard of the Pope, one of the pages of the ambassadress was killed. On this the Duke left Rome. The French troops were put in motion towards Italy, and the Pope was obliged to send his nephew into France, to ask pardon, and to allow a pillar to be erected in Rome itself, as a monument of his own humiliation, and of the triumph of the French monarch. Even England experienced the lofty spirit of Louis: he absolutely refused to pay the honours of the flag; and when Charles remonstrated, he made such vigorous preparations to support his refusal, that the English monarch deemed it prudent to desist. "The King of England," said he to his ambassador D'Estrades, "may know the amount of my force; but he cannot measure the elevation of my mind. Every thing to me is contemptible in comparison with glory."

Soon after his accession, he purchased Dunkirk from the needy King of England. He immediately employed 30,000 men to fortify it by land and sea; and dug a large bason between the town and the citadel, capable of containing several men of war. He soon afterwards obtained, by menaces, the strong hold of Marsal from the Duke of Lorraine; secretly supported Portugal against Spain; and openly gave his assistance to the Dutch against the King of England; though the latter offered to abandon to him all the Spanish Netherlands, provided he would not prevent him from pursuing his advantages over the United Provinces. In 1667, the peace of Breda took place; but Louis was preparing for war. In six years he had accumulated a large sum of money, created a navy, augmented his armies, and provided large magazines, and an immense quantity of military stores. While Colbert regulated the financial department of the kingdom, his other favourite minister, Louvois, directed his genius most successfully to the means of supporting large armies at a distance by magazines. To lead these armies to victory, the Prince of Condé and Marshal Turenne were still in the vigour of life.

Peace of Breda, 1667.

Louis's employment during peace.

Louis, however, during this interval of peace, did not confine his attention and his labours solely to the means of carrying on future wars with advantage and success. He embellished the capital, and paved and lighted it in a magnificent manner; and, for the security of the citizens, established a police, which, from its vigilance and systematic proceedings, soon became the astonishment of Europe. In the provinces, highways and useful works were constructed. In 1664, the canal of Languedoc was begun. In 1666, a council for the reformation of the laws was established. In 1667, the civil ordnance was published; and soon afterwards the code of the waters, forests, the criminal ordinance, &c. followed. Duels, severely prohibited, became less frequent every day.

We have seen that, by the treaty of the Pyrenees, France solemnly renounced all title to the succession of any part of the Spanish dominions, which might arise in consequence of the marriage of Louis with the Infanta of Spain; but on the death of his father-in-law, Philip IV. the French monarch, pretending that no contract could do away a right derived from nature, retracted his renunciation, and laid claim to a part of the Spanish territories. As Philip had left a son, Louis could not advance a claim to Spain itself; but he discovered that there was in Brabant an obsolete law or custom, by which a female of a first marriage was preferred to a male heir of a second marriage; and on this feeble and questionable ground, he claimed the Spanish Netherlands from the son of Philip by a second marriage. Voltaire mentions, that he formed a secret treaty with the emperor, who consented that he should seize on the Spanish Netherlands, on condition that

Claims Spanish Netherlands.

Louis would agree that the Spanish monarchy should revert to him on the death of Charles II. Circumstances were favourable to Louis' claims on Brabant. Besides his own vast preparations, Mary Anne of Austria, regent of Spain, was a very weak and superstitious woman, entirely governed by her confessor, a German Jesuit, whom she appointed grand inquisitor, and placed at the head of her councils. Under such persons, it was not surprising that the internal management and the external defence of the kingdom were neglected. Louis seized on the opportunity thus presented to him, and with an army of 40,000 men, directed by Turenne, paid by Colbert, and amply supplied by Louvois, in 1668 he invaded the Netherlands. The towns, nearly destitute of magazines or garrisons; and their fortifications in a dilapidated condition, surrendered as soon as summoned. Lisle alone resisted for nine days; and the king returned to Paris, after having left garrisons in all the towns, and directed the celebrated Vauban to fortify them.

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ere.
.D. 1668.

The jealousy of the Prince of Condé was roused by the success of Turenne; and, finding that Louvois regarded that general with the same feeling, he proposed, even in the midst of winter, the invasion of Franche Compté, a province dependant on Flanders, or rather a kind of republic under the Spanish dominions, and which was attached to its sovereigns because they did not interfere with their particular privileges, and ruled them with mildness. But Condé did not trust entirely to the force of his arms; secret measures were employed; traitors were found. Besançon and Salins, the two strongest towns, were reduced in a very short time. In four days Dole surrendered; in three weeks of the month of February, the whole province was conquered.

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The rapid success of Louis in the Spanish Netherlands and Franche Compté, alarmed the other powers of Europe, and a triple league was formed by Holland, England, and Sweden, for the purpose of repressing his ambition. Louis, apprehensive of a more powerful combination, offered to give up his queen's rights to Brabant and likewise Franche Compté, provided he might keep the conquests he had made last campaign; and the peace of Aix la Chapelle was formed.

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At the congress for concluding this peace, the deputies from Holland had insulted Louis in a manner that monarch was not likely to forget or forgive. "Do you not rely on the king's word?" said, one day, the French minister to Van Bennery, the Dutch ambassador—"I do not know what the king *will* do," replied he, "but I know what he *can* do." This affront was aggravated by another circumstance: the States ordered a medal to be struck, on which a pompous inscription informed the reader, that the republic had conciliated kings, and restored tranquillity to Europe.

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To motives of ambition, which alone were sufficient to stimulate Louis to war, were now added, in the case of Holland, the feelings of wounded pride. Under the joint influence of these, he prepared to humble the Dutch. He began by detaching Charles II. of England from his alliance with that republic, and bribing him to join France against it. Charles XI. of Sweden joined the league; and even the Bishop of Munster, greedy of war and plunder, and long an enemy to the Dutch, readily concurred in the measures concerted for their destruction.

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At this period of danger, Holland was divided and weakened by two factions; the one headed by John de Witt, a stern republican, of great talents and integrity; the other by the Prince of Orange's partizans, who wished to invest him with the powers and the dignities of his ancestors. De Witt, however, had the command of the resources of the republic at the time when Louis prepared to invade it; and he was blamed for neglecting the land forces, and directing his whole care to the marine. Even after he knew that the French monarch projected an invasion by land, he seems to have been deceived with respect to the side on which it would be made; for he had taken his precautionary and defensive measures almost exclusively on the side of Maestricht. Louis, however, having made an alliance with Cologne, chose that quarter for commencing his hostile operations against Holland. But it was first necessary to enter the territories of the Duke of Lorraine, on which, as he had no hopes of gaining the consent of the Duke, he resolved to seize; endeavouring to justify his conduct on the unsupported and frivolous ground, that intrigues dangerous to the French monarchy had been carrying on at the court of Lorraine. Before he entered the territories of the Dutch, he issued a declaration of war against them. In this he did not condescend to specify particulars, but contented himself with the general and haughty assertion, that the insolence of the Dutch had been so great, that it did not consist with his glory any longer to bear it.

Holland was now threatened with a greater force than had ever been directed against her. The combined fleets of England and France, amounting to upwards of 100 sail, was ready to ravage her coasts; and a French army of 120,000 excellent troops, assisted and directed by the talents of Turenne, Condé, Luxemburg, and Vauban, was preparing to enter the frontiers. Louis passed the Meuse at Visat; and in a very few days, having made himself master of the intervening towns, approached the Rhine. The season was extremely favourable to him; the greatest rivers were almost dried up by the excessive drought; the French cavalry, animated by the presence of their sovereign, plunged into the stream, and were feebly opposed by the Dutch; so that the passage of the Rhine was accomplished with no danger or difficulty. In little more than a month, the provinces of Guelderland, Overyssel, and Utrecht, were in possession of Louis; and the only difficulties remaining were in the provinces of Holland and Zealand. The king here committed an error: instead of pressing forward with his whole force, as he was advised to do by Condé and Turenne, he was prevailed upon by Louvois to add new fortifications to his conquests, which, acquiring additional garrisons, necessarily weakened his main army.

Rapid success of
Louis in it.

In the mean time, the Dutch were successful at sea, De Ruyter having defeated the combined fleets of England and France in Solebay.

The Prince of Orange, unable to withstand the victorious and greatly superior armies of Louis, retired with his dispirited troops into the province of Holland. Naarden, within nine miles of Amsterdam, was reduced by the Marquis of Rochefort; and had he taken possession of Meyden, the keys of which were delivered to some of his troops, but recovered by the magistrates, Amsterdam must have fallen. Louis himself, instead of pushing forward, remained at Utrecht, wasting his time in vain parade. At this period, John de Witt proposed that the States should sue for peace; and carried his proposition, notwithstanding the Prince of Orange was decidedly averse to it. But the deputies were received by Louvois with excessive haughtiness; and the intolerable conditions were insisted on, that the States should give up all their possessions beyond the

Rhine, and some strong places in the very heart of the republic; that they should restore the Roman Catholic religion, and every year send an ambassador to Paris, acknowledging that they held their liberty of France. The deputies instantly rejected these most absurd and humiliating conditions; and, on their return to Amsterdam, John de Witt and his brother were sacrificed by the populace as the authors of their calamities. The Prince of Orange was now chosen Stadtholder, and the most implicit confidence and obedience were shewn him by all parties. As soon as Louis and his ally Charles perceived the effects which the appointment of the Prince of Orange had produced on the determination of the Dutch, they endeavoured to corrupt him by offering him the sovereignty of Holland; but he rejected all their proposals, and prepared for war. The country was inundated; preparations were made to embark for their East India colonies, if their country could not be saved. Providence itself seemed to interfere, by preventing the hostile fleet, with an army on board, from approaching the shores; and Louis, having gained sufficient glory, and finding that his progress was delayed, had returned to Marseilles.

Holland saved by the Prince of Orange.

In 1673, a confederacy, consisting of the Emperor and Spain, which had been alarmed at the conquests and ambition of the French monarch, and had already secretly assisted the United Provinces, openly declared themselves their allies. In three obstinate but indecisive actions, with the fleets of France and England, De Ruyter maintained his character, and protected his country by sea. As soon as the summer commenced, Louis resumed the command of his armies, and in 13 days took Maestricht, one of the strongest bulwarks of the United Provinces. The Prince of Orange, in the mean time, having assembled a respectable army, laid siege to Naarden; and, by its reduction, inspired his countrymen with confidence in his talents, and with hopes of the success of their cause. As soon as Naarden was reduced, he marched to join the Imperialists, who, under Montecuculli, on the banks of the Rhine, was opposed to Turenne. The Imperialists having in vain attempted the passage of that river, in the face of the Marshal, eluded his vigilance, however, and sat down suddenly before Bonne; here they were joined by the Prince of Orange, who had displayed equal talents, in leaving behind him the other French generals. Bonne soon surrendered; and by the fall of several other places in the Electorate of Cologne, the communication between France and the United Provinces was cut off, and Louis was obliged to recal his forces, and abandon his conquests.

Communication between it and France cut off.
A. D. 1673.

In 1674, the Parliament of England obliged Charles to make peace with Holland; and soon afterwards this Monarch offered his mediation to the contending powers. The King of France readily acceded to the offer; but the Prince of Orange, who had great influence in the councils of the United States, and had just obtained the perpetual grant of the office of Stadtholder for his family, and who, besides, was ambitious of military fame, refused the mediation, alleging that it would be in vain to negociate, till a greater impression had been made upon France. Louis, therefore, resolved to open the campaign with such accumulated means, as should render this expectation of the Stadtholder altogether fruitless. He brought three great armies into the field; one on the side of Germany, one in Flanders, and one on the frontiers of Rousillon, while he himself, at the head of a fourth, entered Franche Compté, and subdued the whole province in the space of six weeks. The attacks on Besançon were directed by Vauban, who was so great a master of these operations, and besides found every thing necessary so well supplied by Louvois, that it was reduced in nine days. In Flanders, the Prince of Condé, who commanded the French army, was opposed by the Prince of Orange; the former, though his forces were inferior in number, prevented the latter from penetrating into France; and at last attacked the rear of his army, in a narrow defile at Seneffe; threw them into confusion, and captured a great part of their cannon and baggage. On this occasion, the Prince of Orange, sensible that he had been out-generalled, atoned for his mistake by his personal exertions and courage; he rallied his troops—led them back to the charge; in his turn made the French retire; and obliged Condé to exert desperate efforts to obtain the victory, which he at length atchieved. Such were the deeds of the Prince of Orange in this battle, that his adversary, always candid and magnanimous, remarked, "The Prince of Orange has acted in every thing like an old captain, except exposing his life too like a young soldier." At length the night parted the combatants, and, notwithstanding the advantage which the French obtained at the commencement of the engagement, the victory remained undecided. The Prince of Orange, however, in order to give himself the appearance of having been the conqueror, or to bring the French to a new engagement, besieged Oudenarde; but the Imperial general, who was with him, not choosing to hazard a battle, the siege was raised. Before the close of the campaign, however, he reduced Grave, the last town that the French held in any of the United Provinces.

Louis again successful.
A. D. 1674.

Operations of the Prince of Condé in Flanders

In Alsace, Turenne commanded, and displayed much military skill against a superior army. By a rapid and well-concerted march, he attacked and defeated the Duke of Lorraine, and Caprara, the Imperial general, at Sintzium; and afterwards entered the Palatinate. During his absence in Lorraine, the Imperialists again returned, and with an army of 70,000 men, entered and overran Alsace. This obliged him to come back for the defence of this province; and so unexpected was his arrival, that the Imperialists, taken unawares, were completely defeated, and being dislodged, were obliged to repass the Rhine. The Palatinate was now given up to the most wanton and barbarous destruction. From his castle at Manheim, the Elector beheld two cities and 25 towns in flames. Rapine and lust vied with each other in the dreadful destruction that they committed. The Elector, mad with rage and grief, challenged Turenne to single combat; but the Marshal coolly replied, that he could not accept such a challenge without his master's leave, but would, at any time, meet the Elector in the field, with their respective armies.

Of Turenne in Alsace.

The Palatinate laid waste.

In 1675, Montecuculli was recalled and placed at the head of the Imperial army, in order to oppose Turenne. He endeavoured to penetrate into Alsace, Lorraine, or Burgundy; while Turenne endeavoured to defeat this design. The most consummate skill was displayed on the banks of the Rhine, the scene of their manœuvres, by these two celebrated generals, who had reduced war to a science. Turenne, by posting himself on the German side of the river, not only kept his rival from passing it, but was in a situation to take advantage of any fortunate circumstance that might occur. At last he thought that such a circumstance presented itself, and was preparing to bring the Germans to a decisive engagement, by reconnoitering a situation to erect a bat-

Death of Turenne. A. D.

tery, when he was killed by a cannon ball. Consternation, alarm, and indecision, their natural effects, filled the French army; of this the Imperial general took advantage; and after having been kept three months on the German side of the Rhine, by the talents of Turenne, he passed it the moment he heard of his fate, and penetrated into Alsace. The Prince of Condé, upon this, was sent with a reinforcement to join the army, and supply the place of Turenne; but, before his arrival, a part of the German forces had laid siege to Treves, and Marshal Acqui, advancing to its relief, exposed himself by his negligence to a total defeat, escaping with only four attendants into Treves. Here he resolved to atone for his negligence, by his gallant defence; but the garrison mutinied, opened the gates, and delivered him up to the enemy. As soon as Condé assumed the command of Turenne's army, the good fortune of the Imperialists ceased, as he not only prevented them from establishing themselves in Alsace, but obliged them to repass the Rhine. With this campaign the prince terminated the career of his military glory, passing the remainder of his life in honourable retirement at Chantilly. Montecuculli withdrew at the same time from active service.

Nothing important happened this year on the side of Rousillon. In Flanders, Louis was opposed to the Prince of Orange; but as each was unwilling to hazard a general engagement, the Monarch returned to Versailles.

Louis, thus deprived of two of his ablest generals, was obliged to supply their loss, as far as possible, by the vigour and extensiveness of his preparations for a new campaign; and by a new secret treaty, into which he entered with the King of England. By this, they obliged themselves to enter into no treaties, unless by mutual consent.

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nders.
D. 1677.

Early in the year 1677, Louis placed himself at the head of his army in Flanders, and began his operations, before the enemy's cavalry, for want of forage, could take the field. The Spanish towns, ill fortified, made but a feeble resistance. Condi was taken by storm in four days, and Bouchain was reduced before the middle of May. In order to facilitate the reduction of this place, the King posted himself to such advantage as to prevent the allies from coming to its relief. The Prince of Orange, indeed, came in sight of the French army, but he could not force Louis to fight; and thus was an inactive spectator of the fall of the place, which he had hoped to relieve. Louis soon afterwards returned to Versailles, leaving the command to Marshal Schomberg. As soon as the King had departed, the Prince of Orange laid siege to Maestricht; but the place making a gallant defence, sickness breaking out in the Prince's army, and Schomberg coming to its relief, the siege was abandoned.

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In the midst of these operations by land, Louis did not neglect his navy. A fleet, under the Duke of Vivonne, was sent into the Mediterranean, to support the people of Messina, who had rebelled against the Spaniards; while the latter were aided by a Dutch fleet under the command of De Ruyter. After an obstinate combat, Messina was relieved by the French. Another engagement took place near Augusta, in which the French were also victorious, and De Ruyter was killed. A third, more decisive, was fought off Palermo: the battle was sustained with great vigour on both sides, till the French, taking advantage of a favourable wind, sent some fire ships among the Dutch fleet. All was now confusion and alarm; 12 were sunk, burnt, or taken; 5000 men were killed, and the French fleet were masters of the Mediterranean. They were, however, soon afterwards induced to evacuate Messina at the moment they flattered themselves with the hope of securing it.

During these various operations, a congress had been established at Nimeguen, under the mediation of the King of England. The Dutch were tired of the war, which had greatly increased their taxes; but the Prince of Orange, filled with ambition and animosity against France, persuaded them to continue it, representing, among other reasons, that it was necessary to obtain a strong frontier on the side of Flanders, and that they could not honourably desert their allies. Louis also was desirous of peace; but as he wished for favourable conditions, he was sensible that these could be obtained only by a vigorous prosecution of the war. Thus the negociations leading to no result, the preparations for a new campaign were carried on with great activity on each side. Louis took the field, as usual, as early as February, Louvois having by this time established large magazines. Valenciennes was his first object, which he carried by storm, by making the assault in the morning, when it was least expected, in preference to the night, the usual time; to this he was advised by Vauban. Indeed, he never sate down before any place that he was not almost certain of reducing. He next invested Cambray and St Omers. The Prince of Orange advanced to the relief of the latter place, with an army hastily assembled: the siege was covered by the Duke of Orleans, the King's brother, and Marshal Luxemburg; the former had the effeminate manners of a woman, but these concealed the most ardent courage; the latter had been the intimate friend and favourite pupil of Condé. The Prince of Orange being resolved to raise the siege at any rate, an obstinate battle was fought at Mont Capel, on the 11th of April: For some time the issue was doubtful, till Luxemburg made a masterly movement, which compelled the Prince to seek shelter under the walls of Ypres. The fall of St Omers immediately followed. Louis, always anxious after military fame, and jealous of it in others, could not brook the idea that his brother should have gained a victory by an army, of which he was the commander; he listened to the intelligence with no marks of satisfaction, and never afterwards entrusted the Duke with the chief command. The Prince of Orange, in order to compensate for his defeat, laid siege to Charleroi, but he was forced to raise it on the approach of Marshal Luxemburg.

Battle of
Mont Capel.
A. D. 1677.

Negociations for peace still continued, and they were soon brought to a favourable termination. The Parliament of England obliged Charles to listen to pacific overtures, as they, as well as the nation, were strongly averse to the union with France, especially for the purpose of war against Holland. The Dutch were weary of the war, from which hitherto they had derived no advantage, which could compensate for their additional taxes. France also needed peace; for though victorious in the field, she was exhausted at home. The King had indeed taken the field early in 1678, and had reduced Ghent, while the army under Luxemburg had invested Mons, when the Dutch ambassador at Nimeguen, alarmed at the progress of the enemy, signed the treaty of peace with the ministers of France, by which Louis secured the possession of Franche Compté, Cambray, Aire, St Omers, Valenciennes, Tournay, Ypres, Bouchain, Capel, Charlemont, &c. Maestricht was restored to the United Provinces. Spain re-

Treaty of
Nimeguen.
A. D. 1678.

covered Charleroi, Oudenarde, Aeth, Ghent, and Limburgh. The Emperor gave up Fribourg to the French, but retained Philipsburg. Lorraine was offered again to its Duke, but he chose rather to become a soldier of fortune than accept it under the conditions which Louis insisted upon. The Dutch ambassador, in signing this treaty, had not consulted the Emperor or the King of Spain, both of whom subscribed to the conditions with great reluctance. The Prince of Orange was equally averse to it; and pretending that he did not know that peace was actually signed, he attacked and gained some advantage over Marshal Luxemburg, who concluded the war was terminated, and consequently did not expect this attack.

Louis's encroachments during peace.

Very soon after the peace, the Emperor, Spain, and the United Provinces, disbanded their armies; whereas Louis kept up a formidable force. His motive for this was too soon apparent. Several territories which had formerly been dependant on the three bishoprics of Metz, Toul, and Verdun, and on Alsace, had been for a long time in possession of different German Princes, and Louis wished to unite them to the crown of France. For this purpose he established two chambers, at Metz and Brisac, and these tribunals not only passed a decree for the union which the King wished, but even cited the neighbouring princes, and the King of Spain, to appear before them, and render homage to the King of France, or to submit to the confiscation of their possessions. The Elector Palatine, and the Elector of Treves were deprived of the seignories which they held in this part of Germany. But Louis made a still more daring and unjust attempt the next year, A. D. 1681. Strasburg, a powerful city, which commanded the Rhine by its bridge, was still free, and Louis had long been extremely desirous to annex it to France. Money and threats had been employed in vain,—the magistrates absolutely refused to give it up. At last, by the advice of Louvois, troops were ordered into Lorraine, Alsace, and Franche Compté, under the pretence of employing them to work on the fortifications in these provinces. They all assembled in the neighbourhood of Strasburg, amounting to 20,000 men, and took possession of the ground between the Rhine and that city, as well as of the redoubt that covered the bridge. Louvois, who was at their head, new demanded that the town should be placed under the protection of France. The magistrates, being intimidated or corrupted, and the inhabitants in consternation, the city opened its gates. Its ancient privileges were secured. Vauban was ordered to repair and strengthen its fortifications, and he soon rendered it one of the strongest places in Europe.

Besieges Strasburg. A. D. 1681.

Violent conduct in the Spanish Netherlands.

Louis conducted himself with equal violence and injustice towards the Spaniards, pretending that his minister had forgotten to insert the cession of the county of Alost, in the Low Countries, in the treaty of peace, he demanded that it should be given up to him; and as his demand was not instantly complied with, he besieged Luxemburg. Such proceedings, manifesting a determination not to be bound by any treaty, and violent and oppressive in themselves, alarmed the other powers. The Emperor, King of Sweden, and some other princes, had already endeavoured to rouse the German empire; and if the Elector of Brandenburg had not at that time supported France, war would have recommenced. A congress, however, was held at Frankfort, for the purpose of inquiring into Louis' proceedings with regard to the German territories, which he had annexed to France. To this congress, his plenipotentiaries presented a memorial in the French language. Great disputes arose from this circumstance, Latin having heretofore been the universal language of diplomacy. As there were also other disputes on points equally frivolous, the congress was dissolved, and the business put off till the meeting of the diet at Ratisbon. In the mean time, the French monarch had reduced not only Luxemburg, but Courtray and Dixmude. Upon this, the Spaniards declared war; but they were not supported by any other power. A truce of 20 years was therefore concluded at Ratisbon, by Spain and the Emperor with France, by which Louis agreed to restore Courtray and Dixmude; and was allowed to retain possession of Luxemburg, Strasburg, the fortress of Kehl, and part of the territories which his arbitrary courts at Metz and Brisac had adjudged to him.

His attention to his navy.

Still Louis displayed undoubted proofs of his determination not to continue long at peace; and even while at peace, to augment his power by unjustifiable as well as justifiable means. He paid particular attention to the increase of his navy, and the enlargement and improvement of his ports. He had upwards of 100 sail of the line, and 60,000 seamen. The port of Toulon was constructed; Dunkirk and Brest were repaired, and rendered more fit for the purposes of holding ships of war; and Rochefort, in spite, as it were, of nature, was converted into a convenient harbour. Squadrons were employed against the African pirates: bomb ketches, which had been newly invented by a Frenchman, were used against Algiers in 1681, and again in 1684. This piratical state, as well as those of Tunis and Tripoli, experienced and acknowledged the power of Louis. Genoa next felt his wrath. This republic was accused of selling powder to the pirates, and building galleys for Spain. The city of Genoa was bombarded; and some of its palaces reduced to ashes. The Doge and four of the principal senators were obliged to go to Paris and implore the clemency of Louis, who, in order to prevent the Genoese from depriving him of any part of his triumph, insisted that the Doge should be continued in office, notwithstanding the law of the republic, by which a Doge was deprived of his dignity the moment he quits the city. When the Doge was asked, what he thought most extraordinary at Versailles? he replied, "To see myself there!"

Death of Colbert. A. D. 168

In 1683, Colbert died. The advantages which he had secured to France, were great and numerous: he restored her finances, and established or invigorated her principal manufactures. Subsequent events proved how much France was indebted to him; since, when he ceased to manage the finances, the military successes of Louis languished. As he found that the Protestants, no longer able to oppose the government, or to distinguish themselves by their valour in the field, were disposed to direct their attention to manufactures, he protected and encouraged them. Their ingenuity and industry were rewarded by opulence; and their opulence rendered them the objects of the envy and the jealousy of their Catholic brethren. After the death of Colbert, they were exposed to a persecution at once unjust and impolitic, which terminated in the revocation of the edict of Nantes. Even before this, the Protestants were excluded from all civil employments, and rendered incapable of holding any share in those very manufactures, which they had carried to such an extent and perfection, as to have rendered them the sources of great individual and national wealth. After the death of Colbert, they were placed entirely at the mer-

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e Pro- ants per- uted. D. 1684.

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cy of the Chancellor Tellier, and his son, the Marquis de Louvois, whose leading maxim was, that every person should tremble at the name of the king. In 1684, they sent troops into the Protestant districts; and Louvois wrote, that it was his majesty's pleasure, that all who did not conform to his religion, should suffer the greatest severities. By the revocation of the edict of Nantes, liberty of conscience was abolished; all the Protestant churches were destroyed; and an order was issued even to take their children from them, and put them into the hands of their Catholic relations. The ministers were banished; and the others were prohibited from leaving that kingdom, which the law inflicted on them such unjust and cruel persecution. All the terrors of military execution were employed to make them profess the Catholic religion; and such as relapsed, were exposed to the most dreadful punishments. A twentieth part of the whole body was put to death in a short time; and a price was set on the heads of the rest, who were hunted like wild beasts. Above 500,000 of the most useful and industrious inhabitants of France were driven into exile, by the revocation of the edict of Nantes; and thus the staple manufactures of France not only declined in that country, but were transferred to other nations by these exiles. At the very same time that Louis, out of zeal for the Catholic religion, was thus persecuting the Protestants, he was insulting the Pope, and depriving him of Avignon. The cause of his insulting the head of the Catholic religion, sufficiently proves that Louis was actuated more frequently and strongly by ambition, and a desire to exercise his power, than by any other feeling or principle; and that, even on the most frivolous or unjust pretences, his ruling passions sought opportunities of displaying themselves. The Pope Innocent XI. was a man of talents and abilities; and was extremely anxious to destroy an abominable privilege which rendered nearly one half of Rome an asylum for all sorts of criminals, the ambassadors of Catholic princes in that city extending their right of protection to a great distance from their dwellings. He was also anxious to root out another privilege, by which whatever entered Rome under the sanction of an ambassador's name paid no duty; and thus the trade of the city suffered, and the revenue was defrauded. Several of the Catholic sovereigns, on the representation of the Pope, gave up the abuse of these rights. Louis was next applied to; but he answered, that he never acted after the example of others, but would himself set an example to them; and accordingly he sent his ambassador to Rome, with such a number of guards, as should protect him in the full exercise of these most unjust privileges.

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He begins hostilities. A. D. 1689.

The Palatinate again laid waste.

Such proceedings could not fail to excite the apprehensions of the other potentates of Europe. The Emperor Leopold having succeeded in defeating the Turks, in reducing the Hungarian malcontents, and in securing to the House of Austria the hereditary possession of the throne of Hungary, resolved to oppose the power of Louis. The Prince of Orange, who seems to have had a habitual and cherished hatred of Louis, readily entered into the views of the Emperor; and the league of Augsburg was formed, in order to restrain the encroachments of France, and to secure the objects of the treaties of Westphalia, the Pyrenees, and Nimeguen. Spain, Sweden, Denmark, and Savoy, afterwards joined in the league. Louis, apprized of the designs of these powers, resolved to strike the first blow; and accordingly sent the Dauphin, at the head of 100,000 men, into Germany. After a siege of 19 days, Philipsburg was reduced; Manheim, Frankendal, Spiers, Worms, and Oppenheim, also surrendered; and the Palatinate was again given up to the plunder and devastation of the soldiers, A. D. 1689. Men, women, and children, were driven out into the fields, in the midst of a severe frost, and left to perish of hunger and cold; while their houses were reduced to ashes, their property seized, and their possessions pillaged. More than 40 cities, and an infinite number of villages, were burnt; the palaces of the electors were razed to the ground, and their very tombs opened in search of hidden treasures. This second devastation made the former one under Turenne appear mild and merciful. About this time, England was added to the number of Louis's enemies. James II. had been deposed, and William Prince of Orange chosen in his stead. Louis sent a fleet to Ireland, with troops to support the dethroned monarch. William gladly seized this opportunity of rousing the parliament and people of his new kingdom against Louis.

Forces employed against him.

Battle of Fleurus. A. D. 1690.

The exertions of the French monarch, though great, were not commensurate with the strength and number of the states that opposed him. He had nearly 400,000 men in the field. The army of Spain and the United Provinces, after it was reinforced by the English under the Earl of Marlborough, amounted to nearly 50,000. The Emperor and the German states supplied three armies; one under the Elector of Bavaria, who commanded on the Upper Rhine; the main army under the Duke of Lorraine, on the Middle Rhine; and the third on the Lower Rhine, under the Elector of Brandenburg. The Duke of Lorraine took Mentz, and the Elector of Brandenburg took Bonne, while the Prince of Waldeck obliged the French, under Marshal D'Humiers, to hazard a battle at Walcourt, in which they were defeated. The next year, A. D. 1690, Louis gave the command of this army to Marshal Luxemburg, who, in the plains of Fleurus, defeated the Prince of Waldeck, with the loss of 6000 killed, and 8000 taken prisoners. The Dutch infantry behaved so gallantly on this occasion, that the Marshal observed, "Prince Waldeck ought always to remember the French cavalry; and I shall never forget the Dutch infantry." In Italy, the Duke of Savoy, the celebrated Victor Amadeus, was opposed by the Marshal de Catinat, who had been bred to the law, but whose superior genius soon rendered him an excellent general. He completely defeated the Duke at Staffarada; and in consequence of this victory, the whole of Savoy, except the fortress of Montmelian, was reduced by the French. Catalonia was the scene of hostile operations, in which also the French were successful. But what was more extraordinary, and more flattering to the ambition of Louis, the combined fleets of Holland and England were defeated off Beachy Head, by the French fleet under Tourville.

Siege of Luxemburg.

In the beginning of April 1691, Louis himself took Mons, in defiance of King William. Nothing farther remarkable happened on the side of Flanders. In Italy, Marshal Catinat was held in check by Prince Eugene: on the frontiers of Germany, the war languished; and in Catalonia, the advantages gained by the French were neither splendid nor decisive. The following spring, Louis and William set out on the same day to join their respective armies. Namur was reduced, even in the sight of William, by Louis, with an army of 45,000 men; while Luxemburg, with another army covered the siege. The reduction of this place was rendered remarkable by the circumstance, that Coehorn defended in person a new fort, while Vauban directed the attack. In order to atone for his not having prevented the fall of this important town, William endeavoured to surprise the French army under Luxemburg, at Steinkirk; but after the most daring efforts, he was compelled to retreat. The next year, he was yet more unfortunate; the army of the confederates being defeated with the loss of 8000 men at Landen: Huy and Charleroi fell into the possession of the French, in consequence of their success at Landen. In the mean time, the French fleet under Tourville, who received express and positive orders to fight, that, if victorious, he might invade England, was defeated near Cape La Hogue, by the combined fleets of England and Holland.

In the campaigns of 1694 and 1695, fortune seemed rather to favour the allies: Huy was retaken; the Duke of Savoy penetrated into Dauphiné; and King William, taking advantage of the death of Marshal Luxemburg, invested Namur, which, though it was gallantly defended, was obliged to capitulate in the sight of the French army under Villeroi. About this period, a dreadful famine afflicted France; it was caused partly by unfavourable seasons, and partly by the war not having left labourers sufficient to cultivate the ground. Corn was brought from abroad; and if this had been the only measure adopted, probably the calamity might have been in some measure alleviated; but by attempts to regulate the price, the evil was increased; many of the peasants perished of hunger, and the whole kingdom exhibited a dreadful scene of poverty and distress.

Famine in France.
A. D. 1695.

In consequence of the misery of his people, and the exhausted state of his finances, Louis perceived the necessity either of making peace, or of detaching some of the members from the confederacy. He preferred the latter. A negociation was opened with the Duke of Savoy, who was induced to desert the allies, and to unite himself to Louis, in consideration of the restitution of his dominions; the honours of sovereignty; four millions of money; and the marriage of his daughter with the young Duke of Burgundy, son of the Dauphin.

The campaign of 1697 was not distinguished by any remarkable occurrence, except the taking of Barcelona by the Duke of Vendome, notwithstanding it was gallantly defended by the Prince of Hesse Darmstadt, with a garrison of 10,000 men. This event induced the King of Spain to listen to the proposals of France. A congress for a general peace was opened at the Castle of Ryswick, under the mediation of Charles XI. of Sweden. The Emperor at first was unwilling to listen to terms of accommodation, but finding himself deserted by his allies, he acceded to the treaty.

Peace of Ryswick.
A. D. 1698.

By this treaty, Louis restored to the Spaniards all the places he had taken from them; but the pretensions of the House of Bourbon to the Spanish succession were left in full force. He acknowledged William lawful king of England: with regard to Holland, he adhered to the terms fixed at Munster and Nimeguen. To the empire he restored Kehl and Philipsburg; and to the Emperor, Friburg and Brisac: he even consented to destroy the fortifications of Strasburg on the Rhine; and restored Lorraine, Treves, and the Palatinate, to their respective princes.

Effects of the war on France.

This peace was very unpopular in France, particularly with the inhabitants of Paris, who reproached and insulted the ministers who made it, on their return to the capital; but these people looked only to the victories which the French arms had gained, not to the effects of such an expensive war on the resources of the country, and yet they were very obvious, and plainly pointed out a peace as absolutely necessary. The five first campaigns had cost more than 200,000,000 extraordinary; the finances were in the greatest disorder; that the people might not be oppressed with taxes, recourse was had to loans, to the erecting new offices, and to other measures, which in the end became more extensively and permanently oppressive than additional taxes. The value of the silver mark in coin had been increased three livres in 1689; by which the commerce was injured, the kingdom impoverished, individuals unjustly treated, and the revenue sensibly diminished. In 1695, the capitation tax was established; by it 21,000,000 were raised, but they were at the expence of the other taxes, for the revenue of this year was not on the whole increased.

It has been noticed, that the succession to the throne of Spain, which was claimed by the Bourbon family, was not settled by the terms of the peace of Ryswick; and scarcely was that peace concluded, before it was evident that hostilities would soon recommence from this cause. The King of Spain, a prince equally weak in body and mind, was on the point of dying without children. According to the strict and just rights of consanguinity, only the Imperial or French families had a claim to the throne; but there was another competitor, who founded his claim on a will. The three competitors were, Louis XIV. the Emperor Leopold, and the Elector of Bavaria. Louis and the Emperor were both grandsons of Philip III.; in this respect therefore their claim was equally strong; but the right of birth was in the House of Bourbon, the king and his son the dauphin being both descended from the eldest daughters of Philip III. and Philip IV. respectively. The Imperial family, however, asserted, in support of their claim, the solemn and repeated renunciations of Louis XIII. and XIV. and the blood of Maximilian, the common parent of both branches of the House of Austria. The Elector of Bavaria claimed, as the husband of the only surviving child of the Emperor Leopold by the infanta Margaret, second daughter of Philip IV. who had declared her descendants the heirs of his throne, in preference to his eldest daughter's descendants; so that the will of Philip IV. must be set aside, before the claim of the Elector could be rendered null.

Competitors for the throne of Spain.

In the mean time, a most extraordinary circumstance occurred. William, King of England, who was always so jealous of the power of Louis,—who had used his utmost efforts to restrain or crush it,—and who seemed actuated even by a personal dislike to that monarch,—concluded a partition treaty with him, A. D. 1698, by which it was stipulated, that, on the death of the King of Spain, his dominions should be divided among the claimants, in the following manner: Spain, and all her American possessions, were to be given to the Elector of Bavaria; the kingdom of the Two Sicilies, the ports on the Tuscan shore, and the Marquisate of Final, were to be given to the Dauphin; while the Emperor's second son, the Archduke Charles, was to receive only the dukedom of Milan. As soon as intelligence of this treaty reached the court of Madrid, the King of Spain made a will in favour of his grand nephew the young prince of Bavaria, who died almost immediately afterwards. Upon this, the disquiets and intrigues were renewed; and a second treaty of partition was signed February 8th, A. D. 1699. This treaty differed materially from the former. Spain and the West Indies were to be given to the Archduke Charles; the Milanese to the Duke of Lorraine, who was to annex Lorraine to France; and the Dauphin was, as before, to have the Two Sicilies, the ports on the Tuscan shore, and Final.

Partition treaty.
A. D. 16

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To prevent the union of Spain and the Imperial throne in one person, it was agreed that the Archduke should not succeed to the Spanish throne, in case he was raised to the dignity of king of the Romans, by the death of his eldest brother. On the other hand, in order to prevent the annexation of Spain to France, it was stipulated, that no dauphin or king of France should ever be king of Spain. But the Emperor, expecting the succession to the whole Spanish monarchy, rejected the treaty of partition. The King of Spain nominated the Archduke Charles his universal heir; so that it was evident that the partition treaty would be of no effect, unless the parties who had signed it had recourse to arms; and it was highly probable, that if war took place, Louis would grasp at more than his share, and thus defeat the very object for which he had signed the treaty: indeed, he was already taking measures to gain a strong party at Madrid; for whereas the arrogance of the Queen of Spain, and the grossness and rapacity of her German favourites, disgusted the Spanish nation, a powerful and favourable impression was made on them by the affability, insinuating address, and generosity of the French ambassador, the Marquis D'Harcourt.

The efforts of the Marquis were unintentionally seconded by the Emperor and his son. The former refused 10,000 men, which the King of Spain requested of him, in order to put himself in such a position as would have made the projectors of the treaty respect the independence of the Spanish monarchy; and the Archduke spoke of the Spaniards in reproachful terms. The clergy supported the claims of the House of Bourbon. Even the Pope was consulted, and he answered, that the laws of Spain, and the good of Christendom, required that the House of Bourbon should be preferred. Influenced by this opinion, Charles secretly made a will, in which he nominated the Duke of Anjou, second son of the Dauphin, successor to all his dominions. This prince was preferred, as less likely to unite in his own person the crowns of Spain and France. The King of Spain died some months afterwards.

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Louis at first was undetermined, whether he should adhere to the partition treaty, or accept the will of the King of Spain. At last, by the advice of his council, he accepted the will, and the Duke of Anjou was crowned at Madrid, under the name of Philip V. His grandfather, at parting with him, exclaimed, "There are no more Pyrenees!" He was acknowledged by the Pope, the Duke of Savoy, Venice, the northern potentates, and even Portugal, England, and Holland. Such indeed was the general astonishment at seeing a Bourbon prince on the throne of Spain, that for some time all the powers, except the Emperor, remained in perfect tranquillity. But the King of England was soon roused against France, by the insulting conduct of Louis towards him and the English nation; for on the death of James II. the French monarch proclaimed his son as James III. William upon this, finding that his subjects were equally indignant as himself, concerted the Grand Alliance, as it is called, against Louis. This famous treaty was signed on the 17th of September 1701, by the plenipotentiaries of the Emperor, the King of England, and the United Provinces: its object was to prevent the union of France and Spain, and the French taking possession of the Spanish dominions in America; to obtain satisfaction to the Emperor respecting the Spanish succession; and to secure and protect the dominions and commerce of the English and Dutch. But the death of the King of England, the main spring of this treaty, threw the allies almost into despair, and occasioned the most indecent joy at the court of France. The succession of Anne, however, and her immediate declaration that she adhered to the grand alliance, revived the hopes and the fears of the confederates and the French.

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War in Italy,

Even before the grand alliance was formed, war had begun in Italy between France and the Emperor. Prince Eugene, who commanded the Imperial army of 50,000 men, penetrated through the district of Trent; the French general Catinat not conceiving himself authorised to obstruct his passage, in consequence of orders from his court. The Milanese was thus exposed to danger; and Catinat was replaced by the Marquis of Villeroi. This general imprudently attacked Eugene, and was defeated. The first campaign, after the formation of the grand alliance, was not distinguished by any great event. In Italy, Eugene was not able to follow up his successes, as his army was greatly inferior to the combined forces of France and Spain; indeed, he was obliged to raise the blockade of Mantua, and was defeated in attempting to surprise the French general Vendome near Luaggra. On the upper Rhine, the Prince of Baden was defeated by the Marquis de Villars, who, for this victory, was immediately afterwards created a marshal of France. On the side of Flanders, the cause of the Bourbons was not so prosperous. The Earl of Marlborough, by his masterly movements, succeeded in getting between the enemy and the principal towns of Spanish Guelderland, and reduced such of them as opened the navigation of the Maese, and a free communication with Maestricht. By sea, Louis was unfortunate, the English having destroyed at Vigo a fleet of galleons, which had an immense quantity of money on board. In the beginning of 1703, the Duke of Savoy, who had been long wavering, concluded a treaty with the Emperor. On the 20th of September in that year, the Imperialists were defeated with great slaughter at Hochstet, by Marshal Villars and the Elector of Bavaria. The consequences of this victory were the reduction of Augsburg, and the opening of a passage to Vienna itself. About the same time, the Duke of Burgundy made himself master of old Brisac; and, before the end of the campaign, Marshal Tallard retook Landau, and defeated the Prince of Hesse, who was advancing to its relief.

Germany, and Flanders.

Revolt in the Cevennes.

Soon afterwards, Louis was under the necessity of recalling Marshal Villars, in consequence of a revolt in the Cevennes. This revolt was occasioned by the persecutions of the Protestants, who, roused by some pretended prophets and prophetesses, were maddened with religious fury and enthusiasm. Their war-cry was, "No taxes, and liberty of conscience!" The more they suffered, the greater was their inveteracy and constancy. They principally inhabited lonely and desolate mountains, from which they rushed like wild beasts, and to which they returned when they were pursued or attacked. Marshal Villars, ashamed of having been recalled from scenes of real glory to war against these people, and moreover finding that they could not be completely subdued, thought it better to treat with one of their chiefs, a young baker, to whom the rank of colonel was given. The rebels, however, did not submit at this time; but they were afterwards reduced, and almost exterminated by the Duke of Berwick.

During the absence of Villars, Marshal Tallard was entrusted with the command. The lines of the Elector of Bavaria had been forced by Marlborough, near Donawert, with considerable loss; but the appearance of Tallard inspired that prince with fresh confidence, and it was determined to hazard a general battle. This battle was fought near Blenheim, and, by its result, immortalized Marlborough, and exposed the Electorate of Bavaria to the ravages of the conquerors. Upon this Villars was recalled, and by prudently remaining on the defensive, obliged the Duke of Marlborough to relinquish his plan of penetrating into France by the course of the Moselle.

The Duke of Marlborough having returned to Flanders, Villars was employed in watching the numerous armies of the empire on the Rhine, and succeeded in baffling them by his skill. In Italy, the Duke of Vendome pressed on Prince Eugene and the Duke of Savoy; fought the bloody but indecisive battle of Cassinato; and menaced Turin with a siege. These advantages of the French were balanced by the good fortune of the allies in Spain, where the Archduke Charles, whom they proclaimed king, made himself master of most of that country.

Campaign of 1706.

In 1706, the Marshal Villeroi was defeated by the Duke of Marlborough at Ramillies; and the greatest part of Spanish Flanders rewarded the victors. Louis, instead of reproaching, endeavoured to console the Marshal for this defeat; "People at our time of life, Monsieur Marshal," said he, "are not fortunate." In Italy, the siege of Turin was begun by the Marshal Feuillarde, son-in-law of the minister Chamillard. The siege was covered by the Duke of Orleans, the nephew of Louis, who was however controlled by the superior, but secret powers of the Marshal Marsin. As the preparations for this siege were immense, great expectations were formed of its success; but Feuillarde was by no means fit for his situation; he was ignorant, obstinate, and so conceited, that when Vauban offered to direct the operations of the siege as engineer, he rejected the offer with disdain. The city, however, notwithstanding the incapacity of the Marshal, was reduced to the greatest distress, when Prince Eugene rapidly approached to its relief. The Duke of Orleans wished to have left his lines, and met the enemy; but he was overruled by Marshal Marsin, and the French waited the attack in their entrenchments. In two hours, the Prince obtained a complete victory: the Duke of Orleans was wounded, Marshal Marsin killed, and the duchies of Milan, Mantua, and Piedmont, with the kingdom of Naples, were by this one battle wrested from the House of Bourbon. The affairs of Louis in Spain were equally desperate; but in a short time fortune changed sides there, and Charles was obliged to evacuate his capital, and fly before the Duke of Berwick, who triumphed at Almanza over the forces of the confederates.

Louis' affairs desperate.

Louis having in vain endeavoured to engage the King of Sweden in his cause, began seriously to think of putting an end to a war, by which his arms had been disgraced, and his subjects impoverished. He accordingly ordered the Elector of Bavaria to write letters to the Duke of Marlborough, and the field deputies of the United Provinces, proposing a general congress; offering, as a proof of his sincerity, to give up all the Spanish dominions in Italy to the Archduke Charles; to the United Provinces, a barrier in the Netherlands; and to the Duke of Savoy, a compensation for the waste made by the war in his territories. In return, he asked the restoration of Bavaria to its native Prince; and that Philip V. should be allowed to possess Spain and her American colonies. This offer was, however, indignantly and wantonly rejected, the views of the allies extending with their successes. Having humbled France, they now wished to conquer Spain. They accordingly informed Louis, that no peace could be made with the House of Bourbon, so long as a prince of that house sat on the throne of Spain.

Attempts to negociate in vain.

Louis was not so humbled in means or in hopes, as to be willing to accept these conditions, and he resolved to prosecute the war with vigour; but he was at a loss for money. In this emergency, he issued bills upon the mint to a very large amount, but most foolishly refused to take them in payment of taxes. The consequence was, that they fell into such discredit, as to be at more than 50 per cent. discount. He therefore was obliged to continue the practice of loans, and to anticipate the royal revenue. Still his efforts were astonishing: The coasts of the Channel and Mediterranean were defended by a line of militia; an army was stationed in Flanders, under the Duke of Vendome; another in the neighbourhood of Strasburg, under Villars; two smaller armies were collected in Navarre and Rousillon; and the Duke of Berwick, who still commanded in Spain, was strongly reinforced. These reinforcements came from Italy, where the French troops, amounting to 15,000 men, had been obliged, by capitulation, to evacuate Lombardy.

His astonishing efforts.

In Spain, the House of Bourbon was successful. The Duke of Orleans, who assumed the command after the battle of Almanza, reduced Valentia and Arragon, and took Lerida in Catalonia, which had formerly resisted the great Condé. In Germany, Louis was also fortunate; for Marshal Villars, having passed the Rhine, laid Swabia and Franconia under contribution. France itself, however, was exposed to danger in the midst of these successes; for Prince Eugene and the Duke of Savoy, being perfectly at liberty, in consequence of the French army having evacuated Lombardy, formed a plan, in conjunction with the maritime powers, to reduce Toulon or Marseilles. But, unfortunately for the allies, before the Prince appeared with the van of the Imperialists, the French had found means to throw 8000 men into Toulon, the place which they ultimately had resolved to attack. They had also taken possession of all the eminences that commanded the city; and the allies, in attempting to dislodge them, were repulsed with considerable loss. In consequence, the generals deemed it prudent to give up the attempt. Incidentally, however, this expedition was detrimental to France; for the detachments drawn from the army of Marshal Villars for the defence of Toulon, obliged him to abandon his projects against Germany, and to repass the Rhine.

Campaign of 1708.

In the month of July 1708, the French army under the Duke of Vendome was defeated by the Duke of Marlborough at Oudenarde. Immediately after this battle, the former were joined by a strong reinforcement under the Duke of Berwick from the Rhine, and the latter by Prince Eugene's army. The siege of Lisle, the principal city in French Flanders, and the second in the dominions of Louis, was now besieged by the allies; Eugene being engaged with it directly, and Marlborough covering the siege. Into this place Marshal de Bouflers, an old experienced officer, had thrown himself with some of the best troops of France; but notwithstanding his gallant efforts, and his utmost skill, in the space of two months he was obliged to capitulate. In Italy, the Duke of Savoy attempted to pass through Switzerland, in order to join the troops of the empire in Alsace, and penetrate into France on that side; but he was so vigorously opposed

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by Villars, that he was content with securing his own dominions against the invasions of the enemy, by reducing Exilles, La Perouse, and Fenestully.

Alarm at Paris.

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In consequence of the reduction of Lisle, a road was opened to the very gates of Paris; and the citizens were insulted and alarmed by the predatory excursions of the enemy; of course, they became discontented and weary of the war; and their discontent and misery were increased and participated by the other inhabitants of France, from the circumstance of a severe winter occurring, which destroyed the grain and the olive trees, and threw over their prospects, already gloomy, the certainty of a partial famine. Louis, therefore, was compelled to direct his thoughts to peace. In 1709, he agreed to yield the whole Spanish monarchy to the House of Austria; to cede to the emperor all that he had conquered on the upper Rhine; to give Furnes, Ypres, Menin, Tournay, Conde, and Maubeuge, as a barrier to the United Provinces; to acknowledge the Elector of Brandenburg as King of Prussia, and the Duke of Hanover as the ninth elector of the empire; to remove the Pretender from France, and acknowledge Queen Anne; to restore every thing required by the Duke of Savoy; and to agree to the cessions made to the King of Portugal, by his treaty with the confederates. But the allies, thinking that the moment was arrived when Louis might be still more effectually humbled, demanded, in addition to these terms, his agreement to certain preliminary articles, which were not only so degrading in themselves, but couched in such dictatorial language, that he resolved not to consent to them; threw himself upon his people, and, by explaining the ample concessions which he had offered, roused their indignation and pride. Hostilities therefore were continued. The army of the allies, amounting to 100,000 men, under Eugene and Marlborough, were opposed to Villars, who had been called to the command as the last hope of his country, and who was strongly and advantageously posted between Couriere and Bethune. The allies, after reconnoitring his position, were afraid to attack him, and set down before Tournay; which, notwithstanding the strength both of the town and the citadel—the latter of which had been constructed by Vauban—fell into their power in the course of a month. They now formed the plan of besieging Mons. Villars, on his part, resolved to attempt to save it; but not arriving there before the allies, he took possession of a strong camp about a league from the city, his right extending to the village of Malplaquet. Here was fought a most obstinate battle, in which Marshal Villars was wounded and carried off the field, and the allies were the victors, though their loss was nearly double that of the French. Mons now fell, and its surrender concluded this campaign in Flanders.

ences truy- g. 1710.

As soon as the season for hostile operations was at an end, Louis renewed his applications for peace, and conferences were appointed to be held at Gertruydenburg early in the spring of 1710. At these the French monarch offered additional concessions; but the allies, or rather the Dutch deputies, to whom every thing was left, were still haughty and imperious, insisting that Louis, instead of paying a subsidy toward the war against Philip V. which he had proposed, should assist the confederates with all his forces to drive his grandson from the throne of Spain. Louis could not possibly agree to this most humiliating and barbarous condition; but, as he was extremely desirous of peace, the conferences were not broken off. In the mean time, the confederates continued their successful progress in Flanders: Douay surrendered, the Marshal Villars having in vain attempted to relieve it; Bethune, St Venant, and Aire, were also reduced. In Spain, the cause of the Bourbons was rather successful, and with their successes their drooping spirits revived. In 1711, a change of ministry took place in England; by which, as the friends of the Duke of Marlborough were removed from their places, it was supposed that he also would be deprived of his command, and probably the war terminated; but, as the war was popular, and the Duke a great favourite with the nation, the new ministry did not deem it prudent immediately to recal him, or terminate it. Another event however occurred, which had still greater influence on the state of things; this was the sudden death of the Emperor Joseph. He was succeeded by his brother Charles; and as it was contrary to the general alliance that the same person should possess Spain and the empire, the new ministry of England were no longer afraid to avow their wishes for peace. Hostilities however still continued; but the rigour of the season prevented the Duke of Marlborough from taking the field before the beginning of May; and, after he did take it, no events of importance occurred. Negociations had been for some time secretly carried on between France and England, and on the 27th of September they were privately signed at London. As the allies were not informed of these negociations, they were highly displeased at the intelligence that the preliminaries were signed. But, in the beginning of 1712, general conferences were opened at Utrecht for restoring tranquillity to Europe; the French and English ambassadors declaring, that the preliminaries signed at London were neither binding on the Queen or her allies. While these negociations were going on, the Dauphin of France died; and his eldest son, as well as *his* son, died also. In consequence of these deaths, the Duke of Anjou, a sickly infant, only intervened between the King of Spain and the crown of France. It was now necessary to submit certain propositions to Louis and Philip V. respecting Spain; the latter preferred the possession of the Spanish throne without hesitation, but Louis hesitated before he agreed to the choice of his grandson. He at last complied; and it was agreed, that the renunciation of the throne of France by Philip V. should be registered in the books of the parliament of Paris, and ratified by the cortes of Castile and Arragon.

Change of ministry in England, and death of the Emperor, favourable to Louis, A. D. 1711.

While these negotiations were going on, Prince Eugene proposed to the Duke of Ormond, who had succeeded the Duke of Marlborough, to attack the French army under Villars, in the hope of concluding the war with a splendid victory; but the English general having orders not to act offensively, defeated, by his hesitation, the projects of the prince, who, however, reduced Quesnoy, and sent a detachment to penetrate into the heart of France. Soon after this, the Duke of Ormond made known to the allies the cessation of arms between France and England, and separated the British forces from those of the other confederates. Notwithstanding this diminution of his army, the prince invested Landrecy; but on this occasion he committed errors, which were perceived and taken advantage of by Marshal Villars, who slaughtered or dispersed a body of 14,000 men near Denain. The Marshal followed up this success; and, having reduced Marchiennes, where the principal magazines of the confederates were deposited, he recovered successively Douay, Quesnoy, and Bouchain. The Dutch now, being sensible of their perilous situation acceded to the plan of pacification settled between France and England. Their example was followed by the Duke of Savoy, the King of Portugal, and the Emperor; the last of whom, finding himself unable to support any military operations in Spain, agreed to the evacuation of Catalonia. Thus, as was mentioned before, all the belligerent powers, except the Emperor, being disposed for peace, negociations were opened at Utrecht.

Peace of Utrecht, A. D. 1713.

On the 31st of March 1713, the treaties were signed at Utrecht by the plenipotentiaries of France, England, Portugal, Prussia, Savoy, and the United Provinces; the King of Spain refusing to sign the stipulations, till a principality was provided in the Netherlands for the Princess Orsini, the favourite of his queen. So far as France was concerned, the principal articles were, that Philip V. should renounce all claim to the throne of that kingdom; that the Dukes of Berry and Orleans, the next heirs to the French monarchy after the infant Dauphin, should renounce all right to the crown of Spain, in the event of their accession to the crown of France; that the Rhine should form the boundary of the German empire on the side of France; and that all fortifications beyond that river, possessed or claimed by France, should either be relinquished to the emperor or destroyed; that Luxemburg, Namur, and Charleroi, should be given to the United Provinces, as a barrier, along with Mons, Menon, Tournay, &c. already in their possession; that Lisle, Aire, Bethune, and Dinant, should be restored to France; that Louis should acknowledge the title of Queen Anne, and the eventual succession of the house of Hanover to the British throne; that the fortifications of Dunkirk should be demolished, and the harbour filled up; that Newfoundland, Hudson's Bay, and Nova Scotia, should be given up by France to England; and that the title of King of Prussia should be recognised by Louis, who should at the same time agree to cede to him the town of Gueldres, with part of Spanish Guelderland.

As the Emperor continued obstinate, two months were allowed to him to sign the treaty; in the course of which, as Louis had now no other enemy, and Prince Eugene was not sufficiently strong to oppose Marshal Villars, the latter successively took Worms, Spires, and Landau; pierced the lines which the prince had ordered to be drawn from the Brisgaw, and defeated General Vaubonne in his entrenchments. The Emperor now was anxious for peace, and conferences were opened between Prince Eugene and Marshal Villars at Radstadt. The terms of this treaty, which was concluded on the 6th of March 1714, were less favourable to the Emperor than those offered at Utrecht, as the King of France retained Landau, which he had formerly proposed to cede, and got the Electors of Bavaria and Cologne fully re-established in their dominions. About the same time, Louis persuaded the King of Spain to forego his absurd claim in behalf of the Princess Orsini, and to accede to the general pacification.

Death and character of Louis, A. D. 1715.

Louis did not long survive this peace: he died on the 1st of September 1715, in the 78th year of his age. The events of his reign sufficiently illustrate his character as a monarch. His love of glory and ambition were insatiable, and leapt over the boundaries of justice and humanity, in order to attain its wishes. His courage has, however, been doubted; it is certain, at least, that he never exposed his person, and never, while he commanded the army, undertook the siege of a place which he was not certain to reduce, or fought a battle which he was not certain to win. It must be said in exculpation, that this love of glory and ambition, which led him to cause the destruction of so many of his fellow-creatures, and to despise the plainest and most powerful dictates of justice and humanity, also induced him to patronise and encourage every species of literature, science, and art; so that France was, in his time, equally illustrious, by the great military talents of her generals, and by the splendour of her men of science and literature. At the head of his armies were Turenne, Condé, Luxemburg, Catinat, Crequi, Bouflers, Montesquieu, Vendome, and Villars;—his fleets were commanded by Tourville, Du Quesne, and Du Guay-Trouin;—Colbert, Louvois, Torcy, and Pomponne, directed his councils;—Bossuet, Bourdaloue, and Massillon, taught him his duty;—Vauban fortified his towns; Riquet formed his canals;—Perrault and Mansard constructed his palaces, which were embellished by Le Pouissin, Le Seur, and Le Brun;—Corneille, Racine, Moliere, Quenault, La Fontaine, Bruyere, and Boileau, relieved his more serious cares, by their wit and literature;—and Fenelon, Huet, Flechier, Beauvilliers, and Bossuet, were the instructors of his children.

Louis seems to have seen the folly, if not the injustice, of his pursuits before he died; for he made use of the following memorable expressions to his successor—"Endeavour to preserve peace with your neighbours; I have been too fond of war; do not imitate me in that, or in being too expensive. Take advice on all occasions, and endeavour to discover the best, that you may always follow it. Relieve your people as soon as you can; and do that, which unfortunately I could not do." He also advised him never to forget his duty towards God.

By an edict, which was registered in 1714, he called his legitimated children to the succession, failing the princes of the blood; but this edict was revoked in 1717.

Regency of the Duke of Orleans.

The Duke of Orleans, soon after the death of Louis XIV. appealed to the decision of the Parliament of Paris against the will of that monarch, and was appointed by them sole regent. Although excessively addicted to pleasure, yet, in the early part of his administration, his measures were popular, wise, and beneficial. He restored to the parliament the right of remonstrating against the edicts of the crown; compelled those who had plundered the people, by their extortions during the late reign, to give up their unjustly acquired wealth; repeopled the towns and districts that had been thinned by the ravages of war; nourished commerce and agriculture; and entered into a close alliance with Great Britain and the United Provinces. But his measures were interrupted, and his power threatened, by the intrigues of the Cardinal Alberoni, first minister of Spain. This man, persuading Philip V. that his renunciation of the throne of France was invalid, and that he had a better right to it than the Duke of Orleans, in case of the death of Louis XV. endeavoured to inflame those who were discontented with the measures of the Duke. But his plots having been discovered, his adherents in France were executed, and the Duke's authority was henceforth more firmly established. Soon after this, the Duke formed the quadruple alliance; and Alberoni still continuing his intrigues, a declaration of war against Spain was issued by Great Britain and France. The Duke of Berwick, who had the command of one of the French armies, marched towards the frontiers of Spain, took possession of St Sebastian and Fontarabia; and having made preparations for the siege of some other places in that kingdom, Philip was intimidated into a peace, acceding to the terms prescribed by the quadruple alliance, and dismissing Alberoni. In order to cement the thrones of France and Spain, the Duke of Orleans projected a double marriage; his own daughter being united to the Prince of Asturias, and the Infanta of Spain to the King of France.

Mississippi scheme, A.D. 1716.

In 1716, the famous Mississippi scheme began. John Law, a Scotchman, who had been compelled to fly from England for murder, and afterwards became an adventurer, was the author of it; and the greatness of the idea recommended it to the Duke of Orleans. His project was to pay off the national debt, by the introduction of paper money. A bank was accordingly established, which was soon declared royal, and united with the Mississippi, or West India company, from whose commerce the greatest riches were expected. The opinion that had long been prevalent, that the neighbourhood of the river Mississippi contained inexhaustible treasures, was the origin of this expectation. It would appear, that Law himself, who at first regarded the Mississippi scheme as merely subordinate and auxiliary to his plan of paper credit, was in a short time beguiled by it. In 1719, the notes which he fabricated, exceeded in nominal amount fourscore times the real value of the current coin of the kingdom. At first, only the debts of the state had been paid off in this paper; but afterwards, so extreme was the eagerness to obtain a share in the scheme, that they were circulated very widely through the kingdom. At length, the late financiers, in conjunction with the great bankers, exhausted the royal bank, by continually drawing upon it for large sums. The consequence of this was, that every one wanted to convert his notes into cash; and public credit sunk all at once. Law himself was obliged to flee. Upwards of 500,000 sufferers presented their whole fortunes to government in paper, which, after liquidating these debts, charged itself with the enormous sum of 1631 millions of livres, to be paid in specie.

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In 1723, the king being arrived at the age fixed for his majority, the Duke of Orleans resigned the regency, and was appointed minister, but he did not long survive. He was succeeded in the administration by the Duke of Bourbon, who was soon supplanted by Cardinal Fleury, who had been preceptor to Louis XV. and was now 73 years old. The character of the Cardinal was very different from that of statesmen in general. He was of a mild disposition, and regarded the preservation of peace as the greatest blessing which a sovereign could bestow on his subjects. This blessing therefore he was extremely anxious, during his whole administration, to preserve; and, as Sir Robert Walpole, the minister of Great Britain at this period, was equally pacific, the tranquillity of Europe was continued, with little interruption, for nearly 20 years. At length, the death of the King of Poland, in 1733, rekindled the flames of war, and France was induced to embark in it, in support of Stanislaus, the father-in-law of Louis, (for the Infanta of Spain had been sent back, before the marriage projected by the Duke of Orleans was completed.) France, on this occasion, united with Spain and Sardinia, and hostilities commenced on the side of Germany and Italy. The Duke of Berwick passed the Rhine, but was soon afterwards killed before Philipsburg. In Italy, the Imperialists were defeated by the French; the Spaniards became masters of Naples and Sicily; and the forces of France and Italy, under Villars, took Milan and some other places. Soon after this, Villars died, and his successor, the Marshal de Coigny, defeated the Imperialists, under the walls of Parma.

. 1733.

War of the Pragmatic Sanction.

The Emperor, discouraged by these losses, proposed peace; and Cardinal Fleury, sincere and constant in his wish for it, acceded to the proposal. By the treaty, Stanislaus was to renounce his pretensions to Poland, in consideration of the cession of Lorraine to him during his life; and Louis agreed to restore all his conquests in Germany, and to guarantee the pragmatic sanction, or domestic law, by which the succession to the hereditary dominions of the house of Austria were secured to the heirs female of Charles VI. in case he should die without issue. Soon after this peace, Charles VI. died; and the disputed succession to his hereditary dominions, notwithstanding the pragmatic sanction, kindled anew the flames of war in Europe. By virtue of this sanction, the succession to the whole Austrian dominions belonged to Maria Theresa, the late emperor's eldest daughter, who was married to Francis of Lorraine, Grand Duke of Tuscany. Almost all the European powers had guaranteed the pragmatic sanction; nevertheless, when the period came, in which it was necessary to support it, many of them took up arms to set it aside. The claimants to the dominions of the house of Austria, were the Elector of Bavaria, the King of Poland, the King of Spain, and the King of France; but the last did not appear as a competitor, being afraid of awakening the jealousy of all Europe. These claimants were, however, astonished, when the King of Prussia also appeared among them; and while they were inactive, actually invaded Silesia. Cardinal Fleury, notwithstanding this violent invasion of the pragmatic sanction, was still desirous of peace; but he was unable to withstand the ardour for war in the French councils; and this ardour was increased by the idea, that the period was at length arrived, so long desired by France, for breaking the power of the house of Austria, and exalting that of Bourbon on its ruins. A treaty with the Elector of Bavaria was accordingly concluded, by which the King of France engaged to assist him with his whole force, on condition that, if he succeeded in his projects, he would renounce the barrier treaty, and not attempt to recover any parts of the empire, which France might have conquered; a treaty was also concluded with the King of Prussia at the same time, the object of which was the total dismemberment of the possessions of the house of Austria. The Elector of Bavaria was appointed lieutenant general of the French armies, with the Marshals Belleisle and Broglio to act under him. Louis XV. at the same time, issued a hostile declaration against the King of Great Britain, in his character of Elector of Hanover.

A. D. 1742.

The Elector of Bavaria was very rapid in his progress. Having entered Upper Austria, he took possession of Lints, and sent his detachments to the neighbourhood of Vienna itself. In this extremity, Maria Theresa roused the Hungarians in her behalf; their nobility were instantly in arms; and the Elector of Bavaria, threatened by the forces which Maria Theresa had collected, and finding the season of the year adverse to farther proceedings, gave up the plan of investing Vienna, and marched into Bohemia, where, being joined by 20,000 Saxons, he laid siege to Prague. After the reduction of this place, he was, on the 4th January 1742, elected Emperor, under the name of Charles VII. Here, however, his good fortune terminated: the Prussians and Saxons having been unsuccessful, were obliged to retreat, and the Austrians seized this opportunity of attempting to unite their whole force against the

French, under Marshals Belleisle and Broglio. The King of Prussia, fortunately for the French, prevented their junction; but this monarch soon afterwards suspecting the sincerity of his ally, the King of France, concluded a separate treaty at Breslaw. This unexpected and alarming intelligence was followed by disastrous consequences; for Marshals Broglio and Belleisle, pressed by superior forces, were reduced to the humiliating necessity of offering to evacuate all the places which they held in Bohemia, provided they were permitted to retire with their arms, ammunition, and baggage. This proposal was haughtily rejected by the Queen of Hungary; and Marshal Maillebois, who commanded the French forces on the Rhine, was ordered to march into Bohemia, at the head of 42,000 men. In Westphalia, he was joined by 30,000 French and Imperialists. In the mean time, Marshal Belleisle, who had assumed the command in Prague, was closely pressed by the Prince of Lorraine. The latter, on learning the approach of Marshal Maillebois, turned the siege into a blockade, and advanced with the main body of his army towards the frontiers of the kingdom, in order to oppose the French. He was soon afterwards joined, by a large Austrian army, and in the mean time Marshals Belleisle and Broglio formed the design of uniting with Maillebois. Prince Charles, however, by taking possession of the passes in the mountains, utterly defeated this scheme; and Maillebois was obliged to return to the Palatinate, whither he was followed by the Prince of Lorraine; while the Austrian army, under Lobkouitz, obliged Belleisle and Broglio again to take refuge in Prague.

Siege of Prague, A. D. 1742.

Soon afterwards, Broglio having escaped from this city in disguise, took upon him the command of the French army in the Palatinate; so that the fate of Prague, towards which the attention of all Europe was now directed, depended solely upon the conduct and courage of Belleisle, and the small remains of that gallant army, which had given an Emperor to Germany. Now it was that the powers and resources of Belleisle's mind were made manifest; having formed the plan of his retreat, by making in one quarter of the town a feint for a general forage, and marching out at another, he succeeded in eluding the besiegers, and in reaching the defiles with an unbroken army. In this march he had ten leagues to pass over; the ground was covered with snow; the cold intensely severe; all the inhabitants were his enemies: and as soon as his flight was known, Prince Lobkowitz with 12,000 infantry, aud 8000 cavalry, hung on his rear. After a fatiguing march of twelve days, he reached Egra, and entered Alsace without the loss of a single man from the enemy, though a thousand had perished in consequence of the rigour of the season.

In 1743, the Queen of Hungary being victorious in Germany, and in possession of the territories of the Emperor Charles VII. the French became heartily tired of a war, in which they had suffered so severely, and made proposals of peace, on rather humiliating conditions, though Cardinal Fleury no longer influenced the cabinet of Versailles: he had died in the beginning of this year. But the Queen of Hungary rejected all pacific overtures; and Louis made preparations for carrying on the war with increased vigour and effect. Affairs, however, were still gloomy: the French were driven from all their positions in the Upper Palatinate; and Marshal Broglio was obliged to abandon a strong camp on the Danube, and to retire towards the Rhine. When he reached Donawert, he was joined by 12,000 men under Count Saxe; but his main body being nearly ruined, he still continued his retreat. About this time, the battle of Dettingen was fought between the French and the English; for an account of which, see the article BRITAIN.

Family compact between France and Spain, A. D. 1743.

On the 25th of October in this year, a family compact, or perpetual alliance, was formed between France and Spain at Fontainebleau; in consequence of which the admirals of their combined fleet, in the harbour of Toulon, resolved to give battle to that of England, by which they had been blocked up. The particulars of this engagement are given in the article BRITAIN. Hitherto France and England, though actually engaged in hostilities, had not issued mutual declarations of war. These, however, were put forth towards the end of March 1744. For the particulars of this war, we shall refer our readers to the article BRITAIN; and in this place confine ourselves to the operations of France against Austria and Sardinia. About the beginning of April, the French and Spaniards formed the plan of penetrating into the Duchy of Milan, through the Genoese territories; but the republic not daring, in consequence of the threats of Admiral Matthews, to allow this passage, the French and Spaniards defiled off towards Piedmont, and attacked a strong post, where the King of Sardinia commanded in person. This post they carried; in consequence of which, the King of Sardinia drew off his troops, in order to cover his capital. In the mean time, the confederates invested Coni, the possession of which would have opened them a passage into Milan. The King of Sardinia, on learning this, having been reinforced by 10,000 Austrians, resolved to attempt the relief of the place. He accordingly attacked the French and Spaniards in their entrenchments; but, after an obstinate engagement, he was compelled to retire, not, however, before he had reinforced the garrison of Coni, and supplied it with provisions. As the winter was now approaching, the confederates raised the siege, repassed the mountains, evacuated Piedmont, and entered Dauphiné.

Operations of France against Austria and Sardinia, A. D. 1744.

In the beginning of November, a treaty was concluded at Frankfort, through the influence of France, between the Emperor and King of Prussia, the King of Sweden, and the Elector Palatine, the declared object of which was to restore the imperial dignity, and the tranquillity of Germany, by persuading or obliging the Queen of Hungary to acknowledge Charles VII. The King of Prussia, however, by a separate agreement, was not obliged to take up arms, till he should see France act with vigour. In consequence of this agreement, Louis put himself at the head of his army in Flanders, consisting of 120,000 men, and invested Menin, which surrendered in seven days; several other places were reduced with equal facility: while the allied army, amounting only to 70,000 men, were posted behind the Scheldt. But Louis was soon obliged to leave the scene of his triumphs, to go and defend his own kingdom; for Prince Charles of Lorraine having passed the Rhine, entered Alsace with an army of 60,000 Austrians. Against him, the king dispatched first the Duke of Noailles, and afterwards marched himself; leaving Marshal Saxe, with part of the troops, to oppose the allies in Flanders. This general, though now inferior to them, yet, by his consummate abilities, prevented them from gaining any advantages during the remainder of the campaign.

Louis invades Flanders.

Before the Prince of Lorraine could atchieve any operation of importance, having got information that the King of Prussia had entered Bohemia, he judged it prudent to repass the Rhine; after which, Louis laid siege to Fribourg, and the reduction of this place terminated the campaign on the side of Alsace.

In 1745, Charles VII. died; and his son being too young to become a candidate for the Imperial throne, concluded a peace with the Queen of Hungary. This treaty, it was expected, would lead to a general pacification, as the cause of war in Germany no longer existed; but the Marquis D'Argenson, the French minister, who had great influence in the cabinet, declared that France, having undertaken to give a head to the Germanic body, ought to hazard the last soldier, in support of what she claimed, and had declared she would do. The cabinet of Versailles therefore offered the Imperial throne to the King of Poland; but he refused it. The French were still obstinate; and as they could find no candidate of their own, they determined to continue the war, in order to prevent the election of the husband of Maria Theresa. The republic of Genoa, which had been long wavering in its politics, now concluded a treaty with the House of Bourbon, which turned out fatal to the interests of the Queen of Hungary and the King of Sardinia. The latter was obliged to retire, by the conjoint army of the French, Spaniards, and Neapolitans, beyond the Tanaro; the city of Pavia was taken by assault, and Milan itself forced to surrender. Turin was next threatened; but the confederates, contented with their success, closed the campaign by a triumphant entry into Milan.

The French obstinately continue the war, A. D. 1745.

ampaign Flanders 1745.

Although the avowed object of Louis was to prevent the election of the Grand Duke, yet he had also in view the conquest of Flanders. In order to carry into execution both these plans at once, he assembled two great armies; one on the Maine under the Prince of Conti, and another under Count Saxe, which invested Tournay. As the relief of this place was of great consequence, the allies, consisting of the Austrians, Dutch, Hanoverians, and British, though inferior to the French, resolved to attempt its relief. This gave rise to the battle of Fontenoy; for an account of which, see Britain. After this battle, while the allies were entrenched between Antwerp and Brussels, Marshal Saxe and Count Lauendahl reduced Tournay, Oudenarde, Ath, Dendermond, Ghent, Ostend, and every other fortified place in Austrian Flanders. But though thus successful in this object, Louis was less fortunate in the other object of the war; for he was not able to prevent the Queen of Hungary from raising her husband to the Imperial throne.

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By the treaty of Dresden, the King of Prussia was detached from the house of Bourbon; notwithstanding which, the King of France was determined to push his conquests in the Netherlands, while the King of Great Britain, enraged at Louis for supporting the Pretender, was equally resolved to oppose his projects. Louis commenced the campaign with his usual vigour. Marshal Saxe took Brussels in the beginning of February 1746. In April, the King joined his army, now 120,000 strong; Antwerp was reduced; Mons, one of the strongest places in Flanders, held out only a few weeks; and, by the 10th of July, Louis was master of Flanders, Brabant, and Hainault. The confederates hitherto not able to oppose the French, now mustered 87,000 men, under Prince Charles of Lorraine; and with this force they took up a strong position in the neighbourhood of Namur, as they conceived this place would be next invested. Marshal Saxe, after reconnoitring their situation, did not deem it prudent to attack it; but, in order to attain his object by other means, he reduced Dinant, and thus obtained the command of the navigation of the Maese above Namur, while a large magazine of the confederates was captured at Huy. The communication being now cut off with Maestricht, Prince Charles, from a scarcity of provisions, was obliged to quit his post, and leave Namur to its fate. The garrison was numerous, and the place well defended; yet, on the 6th day, the town was compelled to surrender, and the citadel on the 16th. Marshal Saxe, who never lost a moment's time, immediately after this passed the river Jaar, at the head of the whole French army, and attacked the allies in the villages of Leirs, Warem, and Roucoux, at the same time, by 55 battalions in brigades. As soon as one was repulsed, another advanced; so that the allies, wearied out, and, by some unaccountable neglect, destitute of artillery, were obliged to abandon the villages, and retreat towards Maestricht. The French, however, had suffered so much, that they did not attempt to pursue them. This battle was not attended with any important consequences: with it, the operations in the Low Countries terminated.

As soon as Louis learnt the defection of the King of Prussia, he made, without consulting the court of Madrid, such advantageous proposals to the King of Sardinia, that they were instantly accepted, and a cessation of hostilities took place; but the jealousy and indignation of the Spanish Monarch were so great, that the treaty was annulled. The consequence, however, was injurious to France, as, from the misunderstanding, the French and Spanish armies for some time effected nothing. The king of Sardinia, on the breaking off the treaty, made himself master of Asti, which was garrisoned by 5000 French troops. This circumstance tended still more to foment the jealousy between France and Spain, the French general being accused of treachery in not succouring this place. The Spaniards immediately raised the siege of Milan, and the French, afraid that their communication with Provence might be cut off, retired to Novi. This misunderstanding and jealousy being at last removed, the French and Spanish armies again united, and attacked the Austrian camp at St Lazaro; but they were compelled to retire, after suffering a very severe loss.

Jealousy between France and Spain.

On the death of the king of Spain, the generals of the combined armies, doubtful in what manner his successor would act, were desirous of securing a communication with France, and accordingly commenced a retreat, which was conducted with great ability by the Count de Maillebois, son of the Marshal of that name. The King of Sardinia pursued, and endeavoured to harass them: at Rotto Fredo he brought them to battle, and defeating them, Placentia was obliged to surrender. The French and Spaniards next took shelter under the cannon of Genoa; but not deeming this situation secure, they left the city to its fate, and retreated, the latter into Provence, and the former into Savoy.

Invasion of France by the Austrians.

The King of Sardinia being desirous of turning the victorious Austrians aside from Italy, persuaded them, in conjunction with the British cabinet, to invade France. Count Brunn, who commanded the Austrians, accordingly invaded Provence; but, by the masterly conduct of Marshal Belleisle, he was under the necessity of repassing the Var. Towards the end of this year, the King of France discovered some wish to make peace, and a congress was opened at Breda; it came to nothing, however, as the French were exorbitant, and even insolent, in their demands. After the rupture of this negociation, the States General agreed to unite with Britain and Austria in opposing the ambitious projects of Louis: they were to furnish 40,000, the King of Great Britain an equal number, and Maria Theresa 60,000, all of which were to act in the Netherlands. Another army of 90,000 Austrians and Piedmontese, under the King of Sardinia, was to enter Provence. To oppose the first army, Louis assembled 150,000 men in the Netherlands, over whom was placed Marshal Saxe, with the title of *Mareschal de Campe Generale*. The Spanish army in Savoy was greatly augmented, and 60,000 French troops were stationed in Provence.

Immense preparations against Louis,

The grand army of the confederates took the field in March 1747; but it lay inactive for six weeks, exposed to the inclemency of the weather; while Marshal Saxe's army was within their cantonements at Bruges, Antwerp, and Brussels, furnished with plenty of provisions, and unfatigued. In May, the King of France arrived at Brussels, and resolved to besiege Maestricht. The allies being extremely desirous to preserve this city, the battle of Val, fought on the 1st of July, was the consequence, in which, after various turns of fortune, the Duke of Cumberland, who commanded the allies, was obliged to quit the field, and retire to Maestricht. Marshal Saxe immediately dispatched Count Lauendahl with 30,000 men to invest Bergen-op-Zoom, the strongest fortification in Dutch Brabant. It was taken by storm on the 14th of September, and the French thus rendered masters of the whole navigation of the Scheldt.

who is successful in the Low Countries, A. D. 1747.

The French were equally active on the side of Italy; for Marshal Belleisle having passed the Var, took possession of Nice, and reduced the fortresses of Montalban, Villa Franca, and Ventimiglia. While, however, the French were thus successful in this part of Italy, a powerful army of Austrians and Piedmontese invested Genoa, and probably would have succeeded in their enterprise, had they not been alarmed at the rapid progress of Marshal Belleisle, which induced them to raise the siege, in order to cover Piedmont and Lombardy. The apprehensions of the King of Sardinia respecting Piedmont, were by no means groundless; for the Count Belleisle, brother to the Marshal, endeavoured to penetrate into it by the route of Dauphiné. He was, however, killed in attempting to force the pass of Exilles; and his army having been repeatedly repulsed, was obliged to retire with considerable loss. As soon as the Marshal was informed of this misfortune, he deemed it prudent to retreat towards the Var.

Naval transactions, A. D. 1747.

In her naval transactions of this year, France was very unfortunate; six French ships of war, and four East Indiamen, being taken by the English fleet, commanded by Admirals Anson and Warren; while 46 West Indiamen were captured by Commodore Fox. These losses, however great, were increased by the defeat of a French squadron off Belleisle, and the capture of six ships of the line by Admiral Hawke. Louis perceiving that his naval power was nearly annihilated, while his victories by land were more splendid than advantageous, began seriously to wish for peace; and all the other parties being heartily tired of the war, a congress was opened at Aix-la-Chapelle in the beginning of 1748. Marshal Saxe was not, however, in the mean time idle; he invested Maestricht; and though the state of the siege was unfavourable to the French when the intelligence arrived of the signing of the preliminaries, yet it was agreed, "that, for the glory of the arms of his Most Christian Majesty, the place should be immediately surrendered to his general, but restored on the conclusion of peace." On the 7th of October the definitive treaty was signed, and hostilities ceased in all quarters.

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Treaty of peace.

Disputes between Louis and his parliament.

France, now freed from external war, was threatened with civil commotion, in consequence of religious disputes between the Jesuits and the Jansenists. These disputes had existed in the latter end of the reign of Louis XIV. when the bull Unigenitus, by which the opinions of the Jansenists were condemned, threw all France into the most violent commotion. The death of Louis XIV. however, put an end to the dispute; and as the Duke of Orleans would not allow the bull to be carried into effect, tranquillity was re-established. In 1750, the disputes again broke out; the parliament and the people were inimical to the bull; the Archbishop of Paris endeavoured to enforce it, and Louis XV. at length prohibited the interposition of the Parliament. This body was not disposed to submit quietly, and the King at last banished the refractory members to different parts of the kingdom. In 1754, however, he found it absolutely necessary to recal them; and the Archbishop of Paris, and two bishops, were in their turn banished. A temporary calm was thus produced; but the dispute respecting the bull did not subside, and the King at length referred it to the Pope. The decision of his Holiness, that the bull ought to be acknowledged as an universal law, so enraged the Parliament, that they suppressed the Pope's brief by an arret. This renewed the difference between them and their sovereign, who, in 1756, went to the Parliament with all his guards, and suppressed the 4th and 5th Chambers of Inquest. Upon this, 15 councillors of the Great Chamber, and 124 members of the other courts, resigned; and the King was again under the necessity of accommodating matters with the Parliament. Soon afterwards, the Jesuits were expelled, chiefly by the authority and influence of the Parliament, the members of which, elated at this victory over ecclesiastical tyranny, next attempted to set bounds to the absolute power of the crown. We have brought the history of these ecclesiastical disputes down beyond the period at which we broke off from the political history, both because it is thus rendered connected and complete, and because in it we may clearly trace the germ of those causes which afterwards produced the Revolution.

A.D. 1750

A.D. 1754

A.D. 1756

Ambitious projects of France in America and the East Indies.

Almost immediately after the establishment of peace by the treaty of Aix-la-Chapelle, France began to discover projects of ambition, both in America and the East Indies. These were so glaring, and prejudicial to Great Britain, that, in 1755, that court began to prepare for hostilities. Preparations were also made by the court of Versailles. In 1756, France threatened the Electorate of Hanover; in consequence of which, Great Britain united herself with the King of Prussia, while France formed an alliance with the imperial court of Russia and Sweden. One of the first attempts of the French was the conquest of Minorca, which, not being relieved by Admiral Byng, they succeeded in reducing. In 1757, a French army of 80,000 men passed the Rhine, in order to invade the electorate of Hanover; while a smaller French force joined the imperial army on the Maine. The Duke of Cumberland was invested with the command of the troops which were to protect Hanover; but, attempting in vain to obstruct the progress of the enemy, he was obliged to retire behind the Weser; and afterwards, on the 8th of September, to sign the convention of Closter-Seven. As

Invasion of Hanover, A.D. 17

soon as the French general had thus gained possession of the electorate of Hanover, he formed a junction with the Imperialists. Their object was to drive the Prussians out of Saxony; and, for this purpose, they passed the Saal, and summoned Leipsic. The King of Prussia advanced against them, and fought the battle of Rosbach on the 5th of November 1757, in which he gained a complete victory. Towards the end of this year, the Hanoverians, roused by the oppressions of the French, and headed by Prince Ferdinand of Brunswick, succeeded in forcing them to repass the Rhine. In 1758, the Duke of Belleisle was placed at the head of the military department in France; and the ministers, who had obtained their situations through female influence, were dismissed. The Duke soon discovered how fit he was for the arduous task that he had undertaken. His first object was to strengthen the army on the Rhine; but, notwithstanding this, it was defeated at Crevelt by Prince Ferdinand, and obliged to retire under the cannon of Cologne. In this battle, the son of the Duke of Belleisle was killed,—a young man of great promise, and whose fate was equally lamented by his enemies and his own countrymen. Further reinforcements being sent to the French army, and M. de Coytades having assumed the command, Prince Ferdinand was obliged to act on the defensive for some time: he afterwards joined the British forces, and put his army into winter quarters towards the end of October.

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The naval affairs in 1758 belong more properly to the History of BRITAIN: nevertheless, it may be proper very briefly to notice them here. Two French ships of the line were driven on the coast of Spain by Admiral Osborne. The same fate attended a fleet that was bound for North America. But the success of Britain against France, in other respects, was not so great as her naval supremacy led the inhabitants of the former country to expect, and of the latter to dread; for an expedition, prepared at considerable expence, and from which great expectations were formed, to the coast of France, by no means produced the triumph to Britain, or the loss and degradation to her enemy, which was anticipated. Cherbourg, indeed, was taken, and the fortifications demolished; but, in consequence of the accumulating force which the French collected, it was then deemed necessary to retreat: and at St Cas the retreating army suffered severely.

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In America, where the war may be said to have originated, the French were unsuccessful. Louisburg was besieged and taken; and the whole island of Cape Breton, as well as that of St John, submitted to the arms of his Britannic Majesty. The French settlements on the river Senegal, and the island of Goree, were also wrested from them. In the East Indies, however, the Count de Lally, governor-general of their possessions there, was more fortunate, having taken possession of the British factories of Cuddalore and Fort St David's.

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In the beginning of 1759, the French made themselves masters, by an act of perfidy, of Frankfort on the Mayne. As this acquisition secured to them the course of the Maine and the Upper Rhine, the allies resolved to attempt their dislodgment; but Prince Ferdinand, in attempting to gain possession of the village of Bergen, which was necessary for this purpose, was repulsed by the Duke of Broglio. Soon afterwards, the French armies on the Upper and Lower Rhine formed a junction, which rendered it prudent for the Prince to retire. Nothing now intervened to prevent them from taking possession of Munster and Minden; and the acquisition of them exposed Hanover to great danger. The Prince, therefore, in order to save the electorate, resolved to give them battle; and the battle of Minden was fought, in consequence, on the 1st of August. Although the result of this battle was, perhaps, not so satisfactory and advantageous to the Prince as it might have been, it enabled him to defend the electorate effectually. No other event of consequence having taken place this year on the Continent of Europe, in which the French were concerned, we shall now briefly notice the disasters that attended them in the West Indies, North America, the East Indies, and by sea. In the West Indies, Guadaloupe was reduced, though they saved Martinique from the attack of the English. In North America, the genius and gallantry of Wolf stripped them of all their possessions, by the victory which he gained on the heights of Abraham. In the East Indies, General Lally was at first successful: he even attempted the siege of Madras, but he was obliged to abandon the enterprise. The French were afterwards defeated with great slaughter in two engagements. By sea they were more than usually unfortunate this year; for, making preparations for an invasion of Britain, all their ports in the Channel were blocked up by Admirals Rodney and Hawke; while Admiral Boscawen, for a time, succeeded in blocking up their fleet in the harbour of Toulon. The French Admiral, however, found an opportunity to escape; and the sea-fight off Cape Logos was the consequence, in which the Toulon fleet was defeated, with the loss of four ships of the line. Notwithstanding these disasters, the French minister seemed still bent on invading England; and the English fleet having been driven off the coast of France in a storm, Admiral Conflans put to sea with 21 sail of the line and some frigates: He was met by Admiral Hawke, and defeated with great loss, between Belleisle and Cape Quiberon.

Disasters of the French in America, the East and West Indies, and by sea.

Campaign of 1760.

In order to compensate for these losses, the French government resolved to open the campaign of 1760 in Europe with immense force; and as the nobility and gentry seconded the exertions of the government, it was enabled to augment the army in Westphalia, under Marshal Broglio, to 100,000. The allied army under Prince Ferdinand, though less numerous, was better appointed. Nothing of importance occurred between them till the 31st of July, when the French were defeated at the battle of Warburg, and obliged to retreat with the loss of 3000 men. In consequence of this victory, Prince Ferdinand was enabled to protect Hanover; but the dominions of the Landgrave of Hesse were still exposed to the French. Soon afterwards both armies went into winter quarters. In the East Indies the French were stripped of nearly all their possessions this year.

The death of George II. led the French government to hope that his successor might be disposed to relax in his efforts to support the continental war; but as soon as they were convinced, from the liberal supplies voted by the British parliament for the support of the German confederacy, that their expectations were ill founded, they, in conjunction with the court of Vienna, proposed terms of peace. A congress was accordingly appointed to be held at Augsburg for the continental powers; while the separate discussions between Britain and France were to take place at Paris and London. Notwithstanding these negociations, hostilities were still carried on; and, with respect to the particular dispute between France and England, it was soon evident, that it was more likely to be extended than adjusted; in consequence of the disposition which the court of Madrid displayed to unite with France. The principal scene of the French military operations was Westphalia, where at first they were successful, obliging Prince Ferdinand to retire behind the Dymel; but that indefatigable general soon afterwards repulsed the united forces of Broglio and Soubere, and thus was enabled to effect his grand object, the protection of Hanover. Still, however, the campaign was as indecisive, with regard to permanent or extensive advantage on either side, as any of the former campaigns had been; and it was evident, that such operations would exhaust the resources both of the French and the allies. As the British ministry felt their peculiar strength to consist in the command which they now possessed of the sea, they planned another expedition against the coast of France, which effected the reduction of Belleisle. This, no doubt, was a great mortification to France, but it did not induce her to weaken her Westphalian army; and therefore, as a diversion in favour of Prince Ferdinand, it totally failed, while it was impossible for the British to retain their conquest. The negociations were now again resumed; but as the offers of cessions and exchanges made by the court of Versailles did not meet the expectations of the British cabinet, they were finally broken off. The cause of this failure was soon traced to the court of Madrid, between which and the court of Versailles a family compact had been some time before entered into. According to this compact, the Kings of France and Spain were to have common enemies and friends; so that war declared against one was to be regarded as war declared against both; and consequently, on such an event happening, the whole military forces of both were to act in the most perfect concert. No peace was to be made except by mutual consent. Spain, however, was not to succour France when she might be involved in a war in consequence of her engagements by the treaty of Westphalia, or her other alliances in Germany or the north, unless some maritime power took part in those wars, or France itself were attacked. Between the accession of Spain to the cause of France in her war with Britain, and the peace of Paris, no event of importance occurred, except the reduction of the island of Martinico by a British armament.

Spain assists France.

In consequence of a change of the British ministry, France found that a peace was more practicable than formerly, while she herself, as well as Spain, were more sincerely disposed towards it: negociations, therefore, were carried on at Fontainebleau, and on the third of November 1762, the preliminaries were signed there. On the 16th of February, in the following year, the definitive treaty was signed at Paris. By this treaty France agreed to cede to Britain, Canada, in its utmost extent, with the islands of Cape Breton and St John, and all that part of Louisiana which lies on the side of the Missisippi, except the town and territory of New Orleans. The French were permitted to fish, under certain limitations, on the banks of Newfoundland: the islands of Martinique, Guadaloupe, St Lucie, Goree, and Bellisle, were restored to them; and the French East India Company were placed in the same situation in which they were at the peace of Aix-la-Chapelle, by the restitution of Pondicherry, &c.; but they were not to erect any forts in the Province of Bengal. France agreed to cede to Great Britain the forts and factories she had lost on the river Senegal, the island of Grenada and its dependencies, and to give up all claim to the neutral islands of St Vincent, Dominica, and Tobago; she also consented to destroy the harbour and demolish the fortifications of Dunkirk.

Peace of Paris, 1763.

Disputes between the King and the Parliaments.

France had much need of repose; for, not only were her finances in a very dilapidated condition, but disputes between the King and the parliaments agitated the minds of all: these disputes have been already noticed. And as the parliaments felt their own power and importance, while the King became sensible of the necessity of curbing them, they every day became more serious. The parliament of Paris refused to register several of the royal edicts; and the parliament of Brittany, determined to manifest that they also were adverse to the King, refused the crown a gift of 700,000 livres, in consequence of which they were dissolved. But Louis, afraid of creating still greater disturbances, published a general amnesty, and wished them to resume their functions. The parliament, however, convinced by this that the King was intimidated, and their cause was popular, refused to accept his proffered clemency. The indignation of the King was now extreme; and he ordered such of the councillors of the parliament of Brittany as had refused to resume their functions, to be included in the list of those who were to be drafted for the militia; and such as were drafted were actually obliged to join their regiments, while the rest were incorporated in the city guard. The severity of this conduct appeased the stubborn spirits of the parliaments for some time; but the calm was not of long duration. In the midst of these convulsions, which extended to nearly all the parliaments in France, the Dauphin died, in the 37th year of his age; and the Duke of Berri, his eldest son by his second marriage with Maria Josepha of Saxony, was created Dauphin in his stead.

Corsica annexed to France.

As soon as Louis had in some measure quieted the parliament, he turned his attention to the acquisition of Corsica. This island had for some time resisted the tyranny of Genoa, which claimed the sovereignty by right of conquest: At last the Republic, unable to support her pretensions, transferred them to France, on condition that Louis should put her in possession of the island of Capraria, which the Corsicans had lately reduced. Louis thought that the subjection of the Corsicans would be easily and speedily effected; but he found himself much mistaken, as the Corsicans defended themselves with great intrepidity; and two campaigns, with the loss of several thousand men, were necessary to bring them under the power of France.

Financial distress of France, A.D. 1768, 9.

The finances of the country were at this period, A. D. 1768, 1769, very inadequate for the support even of such a trifling war as that in Corsica. The East India Company were absolutely bankrupts; numbers of the most respectable merchants were exposed to every species of failure and distress. Such a state of things required the measures of a man of talents and experience; whereas the Duke of Choiseul, who was minister, was neither, and by attempting to remedy, he actually increased the evil: he reduced, at once, the interest of the public funds one half; and, as if this were not sufficient to injure public credit, he took away the benefit of survivorship in the tontines. The king at last was under the necessity of banishing him; but, instead of remedying the evils by the restoration of public credit and confidence, and by calling in to his assistance the advice and authority of the parliaments, Louis again involved himself in disputes with them. As he had no idea of carrying his measures calmly, he resolved to banish the parliament of Paris, which had given the tone to the others; and, soon after this was done, several of the provincial parliaments were dissolved. It was necessary, however, to appoint new parliaments; and though the people did not view them with their accustomed respect, the King received from them unlimited obedience.

Marriage of the Dauphin.

In the midst of these disputes, which would scarcely be worthy of notice did they not point out the causes of the Revolution, the Dauphin was married to Maria Antoniette, sister to the Emperor of Germany. At the splendid entertainment and shows given on this occasion, a dreadful accident happened: the crowd hastening to be the spectators of the fireworks, pressed on one another in such a tumultuous manner, that several hundreds perished in the confusion.

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As soon as Louis had freed himself from the opposition of his parliaments; he gave himself up completely to debauchery; but his health was not equal to the inroads made upon it; and his satiated appetite required the constant stimulus of new beauty, and a succession of mistresses. One of these, who was infected with the small-pox, communicated the disorder to the king. The danger hourly increased; and Louis, apprised of his approaching dissolution, fondly hoped to atone for his past debaucheries, by his present penitence: He received the sacrament; and declared his intention, if he should survive, of exerting himself in the cause of religion, and for the benefit of his subjects; but in eight days after the first attack, he closed his reign of 59 years, and a life of 65.

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This monarch had nothing to recommend him to the affection or gratitude of his people, though, at the beginning of his reign, in the moment of danger, the appellation of *well-beloved* had been conferred upon him. Thirty years of rapacity, profusion, and tyranny, as a monarch, and of the most profligate debauchery in his private life, had, however, induced the people to retract that appellation. His example loosened the bands of morality; the credit and resources of the country had been nearly exhausted by his prodigality; what remained of a free constitution in France had been crushed, as far as he could crush it, by his tyrannical measures. He does not seem to have been capable of any generous feeling; his affections were confined within the narrow limits of his personal pleasures and security; whoever could administer the one, or accomplish the other, was with him a favourite; but as soon as they ceased to be useful in these respects, they were neglected and forgotten. Even the Marchioness of Pompadour, who had so long enjoyed his confidence and shared his embraces, expired, without drawing a single sigh of regret or affection from the breast of Louis, though, during her life, he had obeyed and adored her; and to the death of the Dauphin he was equally insensible. Even his exertions against the parliaments would not have been made, though his principles and feelings were sufficiently arbitrary to have led him to have wished their annihilation, had not his indolence been goaded on by the stimulating representations of the Countess du Barri, that while they existed he was in personal danger.

XVI. 1774.

Louis XVI. was twenty years of age, when, in the year 1774, he succeeded to his grandfather. One of his first measures was, to remove those from office, who, by their errors or misconduct, had become unpopular, and had contributed to the distresses of the kingdom; and to replace them by men of talents and honesty. He likewise gave great satisfaction, by suppressing the new, and recalling the ancient parliament of Paris, though, at the same time, he limited their privileges, and declared his intention not to submit to any power in them, which could possibly circumscribe his own. Scarcely were the members returned, however, before they displayed their spirit and pretensions; but Louis, in answer to one of their representations, peremptorily declared that he must be obeyed.

Turgot at the head of the finances, A. D. 1775.

State of France.

The state of the finances was still such as to require great care in their management, and in their restoration. For this purpose, the celebrated Turgot was placed at their head in the year 1775. His measures, in some respects, were undoubtedly wise and salutary; but, in other respects, he seems to have suffered speculative opinions too much to influence him. Even his wisest plan, that of rendering the internal commerce of grain, as well as its exportation, free and unrestricted, gave rise to serious disturbances, in consequence of a scarcity of corn happening at the very time of his regulations. The tranquillity of the country, as well as of Paris, was so much disturbed, that Louis found it absolutely necessary to have recourse to very strong measures; and the Marechaussee, a military body dependant on the police, were ordered to disperse the multitude, and to execute summary justice on the most guilty. After the suppression of these disorders, Louis, in order to draw off the minds of his subjects from the unpleasant recollection of them, and of the harsh means by which they had been quelled, resolved to celebrate his coronation with great magnificence at Rheims; and, to prove that the measures he had lately been compelled to adopt were not the result of a cruel or tyrannical disposition, he issued an edict, which in future sentenced deserters to work as slaves on the public roads, instead of punishing them, as formerly, with death. He also suppressed the mousquetaires, and reduced part of the regular army. By the former measure, he relieved the citizens of Paris from an impetuous and overbearing body of men, the suppression of whom no former sovereign had ventured to effect; and, by the latter measure, he gave gratifying testimony to the nation at large, that he was resolved to introduce the strictest economy.

France increases her marine.

Still, however, the situation of the world rendered it prudent for Louis to direct his thoughts to the not improbable renewal of hostilities. Great Britain was at this time involved in serious disputes with her colonies. France, however disposed to remain at peace, on account of the state of her finances, was too interested in the humiliation of Britain, not to regard with satisfaction the progress of a dispute, which might afford her a fair opportunity of weakening her ancient rival. This would be best effected by being able to meet that rival on her own element. The navy of France was therefore an object of great interest; and the appointment of Monsieur Sartine to the superintendance of the marine, did honour to the penetration of Louis. He was fruitful in his resources, and unwearied in his application; and in a short time, the losses of the last war were nearly supplied.

But the finances were not so easily managed. Turgot, not possessing the public confidence, had resigned, and

Neckar succeeds Turgot.

Neckar was soon afterwards placed at their head. In order that he might carry into full and uncontrolled effect all his plans, the entire management of the funds and revenue of France was submitted to him, with the title of director-general of the finances.

Voyages of discovery.

The interests of science next engaged the attention of Louis and his ministers. Several vessels were fitted out on astronomical discoveries. The Chevalier de Borda was instructed to ascertain the exact position of the Canary Islands and the Cape de Verd, and the different degrees of the coast of Africa, from Cape Spartel to the island of Goree. The Chevalier Grenier, who had traversed the Indian ocean, for the purpose of improving the charts, and correcting the errors which had misled former navigators, was liberally rewarded.

France favours the revolution in America.

In proportion as the success of the Americans increased the probability that they would ultimately establish their independence, the French cabinet, as well as the French nobility, were desirous of uniting with them, and thus contributing to the humiliation of Britain. But the former concealed their wishes and their resolutions, and even restrained the ardour of the latter, till a proper opportunity offered itself of openly taking part with the Americans. As soon as the measures of Great Britain had roused the people of her colonies to the daring resolution of rising against their mother country, Silas Deane and Dr Franklin were sent to Paris. Here they exerted secretly their influence with the leading men in the French cabinet; and though, in a public capacity, they were not admitted to an audience, yet they received sufficient encouragement to hope, that, before long, their country would be assisted by the arms of France. In the mean time, the American privateers were allowed to refit in the French ports, and even to bring their prizes into them. Warlike stores were sold or given to the colonists; French officers and engineers, with the connivance of government, entered into their service; and the Marquis de la Fayette, a young nobleman of affluent fortune and high birth, sailed for America, where he was received with open arms, and appointed to a principal command. These circumstances naturally excited the suspicions of the British court; but, as nothing was done openly, they had no sufficient ground for remonstrating, till warlike preparations were carried on in such an undisguised manner, and to such an extent, as could leave no doubt that France was on the eve of hostilities with some power. Upon this, the English ambassador at Paris closely questioned the French minister, who replied, that when the seas were covered with English and American ships of war, and when large armies were sent to the New World, it became prudent for France to arm for the defence of her colonies, and the protection of her commerce. The outward forms and the language of neutrality, were, however, preserved, till the capture of General Burgoyne and his army, when they were at once dismissed from the French cabinet, and the independence of the United States of America was openly acknowledged. Silas Deane and Dr Franklin were received as public ambassadors, and a treaty of amity and commerce was signed in the month of February 1778. The recal of the English ambassador from Paris was the signal for the commencement of hostilities. The details of this war between Britain and France having been already given in our article Britain, we shall confine ourselves to the domestic transactions of France.

Treaty of amity and commerce with the United States, A. D. 1778.

Monsieur Neckar still continued at the head of the finances, and endeavoured to render the pressure of the war as light as possible, by plans of economy and retrenchment; a variety of unnecessary offices in the household of the King and Queen were abolished, and other important regulations adopted for the benefit of the kingdom. At the same time, the diplomatic skill, experience, and intrigues, of the different French ambassadors at the courts of Europe, were successfully exercised in rousing them, either directly or indirectly, to take advantage of the present circumstances, and crush, or at least weaken, the naval power of Britain. As a long and intimate connection had subsisted between the courts of Petersburgh and London, the French ambassador at the former was instructed to conciliate the inclinations of the Empress; and he conducted himself with so much adroitness, as to be very instrumental in persuading her to place herself at the head of the Northern Confederacy. In answer to the declaration which she addressed to the courts of Madrid, Paris, and London, on the subject of neutral rights, the King of France declared, that what her Imperial Majesty claimed from the belligerent powers exactly corresponded with the rules prescribed to the French navy; and as he was convinced solid advantages would undoubtedly result, not only to her subjects, but also to all nations, she might depend that he would adhere to his usual practice, and comply with her wishes. Towards the close of the year 1780, Monsieur Sartine was removed from the marine department, which he had superintended for five years. His great and leading object had been, during the whole of this time, to place the French navy upon the most extensive and efficient footing; and he had succeeded in raising her naval power to an unprecedented height; but his measures for this purpose necessarily required the expenditure of very large sums of money, at a time when the state of the finances loudly called for economy and retrenchment. Hence his measures and wishes were at variance with those of the comptroller-general of the finances; and his removal was the consequence. He was succeeded by the Marquis de Castries.

A. D. 1780.

Humane and economical measures of Louis.

The disposition of Louis, naturally humane, was most honourably displayed this year, by the abolition of the practice of *putting the question* by torture; and his desire to relieve his subjects as much as possible from the pressure of the taxes, was evinced by the further diminution of his own expenditure, and by his dismissing at once 406 officers belonging to his court. In this adherence to a system of economy so unusual in the sovereigns of France, Louis was undoubtedly strengthened by the advice, and perhaps the remonstrances, of Neckar. This minister continued to be uncommonly active and faithful in the discharge of the duties of his important and arduous situation; but he was rather a man of detail than of general principles or comprehensive mind; and he did not always perceive the necessity or advantage of accommodating his plans, in some degree, to the habits and prejudices of the French nation. He conceived the impracticable idea of maintaining the war by loans, without additional taxes; not reflecting that loans cannot be raised in any country, in which there is not only a great superabundance of capital, but also the most implicit confidence in the faith of government. Unfortunately for his scheme, capital was far from being abundant in France, and the measures of former sovereigns, as well as the nature of the government, were by no means calculated to inspire confidence.

Character of Neckar.

There were besides other causes, which shook the popularity of Neckar; his temper was austere and unaccommodating; the reforms and retrenchments which he had introduced into the various departments of the royal household, were represented as derogatory to the dignity and splendour of the crown; and his foreign birth and mercantile education and habits, increased the jealousy and dislike created by his temper and plans of economy. The King for some time endeavoured to oppose his favour and countenance to the intrigues that were formed against him; but at length, towards the close of 1781, he was dismissed from his office of comptroller-general, and Monsieur de Joli Fleury succeeded him. The people at large beheld this change with regret, which was by no means diminished when the new comptroller-general reverted to the old plan of raising taxes. It was, however, soon ascertained, that the burdens of the nation could not be much more augmented; and the ministry, in order to multiply the resources of government, without pushing taxation to a dangerous extent, endeavoured to kindle in Paris, and throughout the provinces, such a degree of enthusiasm as would produce voluntary contributions towards carrying on the war. Their efforts were seconded by the consternation and feeling of humiliated pride, which the defeat of Count de Grasse produced throughout the kingdom; and several states displayed their zeal in building and fitting out ships of war, to repair the loss which had been occasioned by this defeat. The clergy also came forward at this time, with a free gift of 15,000,000 of livres towards the exigencies of the state; and they also offered another million to be applied to the support of wounded seamen, and of the widows and orphans of those who had been killed in the various naval engagements.

Neckar is dismissed, A. D. 1781.

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About this period, the attention of the French ministry was directed to the commotions that agitated the republic of Geneva. These commotions arose from the magistrates and senate having increased their own authority, and diminished the privileges of the people: the latter were still farther irritated by the additional taxes which were imposed upon them; and, at length, their leaders insisted on having a regular code of laws, which might prescribe the authority of the rulers, and sanction the rights of the people. The aristocracy objected to this; and in their own support called for the interference of foreign powers. The King of France, as protector of the republic, concerted, with the King of Sardinia, and the cantons of Zurich and Berne, such measures as they thought would restore tranquillity to it; and in order to give weight to these measures, an army of 12,000 men was encamped under the walls of the city. Thus protected, the magistrates gained a complete ascendency over the people; but they afterwards, during the French Revolution, had too good reason to repent having called in the interference of France, thus virtually acknowledging a dependence on that power, which was not forgotten.

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Although the preparations for war in 1783 were very great, yet Louis was disposed for peace, and therefore accepted the mediation of the Emperor of Germany and the Empress of Russia. This mediation was successful, and a treaty of peace with Great Britain was concluded on the 20th of January. By this treaty, France acquired an additional extent of fishery off Newfoundland. In the West Indies, she regained St Lucie and Tobago, but relinquished Grenada, St Vincent's, Dominica, St Christopher's, Nevis, and Montserrat. In Africa, she acquired the full sovereignty of the forts on the Senegal, and regained Goree; while she guaranteed to Britain, Fort St James's, and the river Gambia. In the East Indies, all that she had lost was restored, and some additions were made to her former possessions. But the most gratifying article of this treaty to the national glory of France, was, that the fortifications of Dunkirk were no longer to be forbidden,—the stipulations exacted from Louis XIV. and XV. respecting them being formally abolished by the peace of Paris.

Financial embarrassment.

The joy created in France by the termination of a war, in which she had been so eminently successful in weakening Great Britain, was not of long duration. The state of her finances grew daily worse. Three different successors of Monsieur Neckar had in vain attempted to remedy or palliate the evil; public credit, as well as the public resources, were too nearly exhausted to be revived. Government refused, or delayed the payment of the bills drawn upon them by their army in America; and nearly at the same time the Caisse d'Escompté stopt payment. This last circumstance created general and excessive alarm. Their notes having been hitherto always convertible into specie at the option of the holders, had circulated very widely; and as they were not out to individuals at this period to a larger amount than usual, or than their known capital authorised, the suspicion was created that they had, to the prejudice of the holders of their notes, and contrary to their own interest, as well as that of the public at large, accommodated government with the specie, which ought to have been exclusively devoted to the payment of their notes. It now became absolutely necessary for government to interfere, in order, by supporting this bank, to restore the confidence of the public in it. Four edicts, therefore, were issued with this view: by these, the banks of Paris were ordered to receive the notes of the Caisse d'Escompté as currency; and a lottery, with a stock of one million sterling, was established, redeemable in eight years, the tickets for which might be purchased in the depreciated notes. At the same time, government having procured money, paid their American bills. Public credit was thus restored; and the stock of the Caisse d'Escompté rose considerably above its original subscription.

The comparison between the measures adopted in England, when its national bank declared their inability to pay in cash, and those adopted in France on the present occasion, cannot fail to strike the reader. In the former country, all that was absolutely necessary for the support of the bank was accomplished by individuals; in the latter, it was the exclusive work of the government. In the former country, a temporary alarm had shaken public credit; but the wealth and real confidence of the nation remaining the same, as soon as that alarm subsided, public credit was again placed on as solid a foundation as before: whereas, in France, the shock given to public credit arose from permanent causes, and the measures adopted only palliated, or put off the evil.

The state of the finances of France, thus artificially kept from falling into utter ruin, absolutely required the most rigid and systematic economy: indeed, no other means could restore them even to temporary strength; and yet, not only were the forces not reduced, but all the deficiencies in the different regiments were made good. At this period, there could exist no alarm or probability of renewed hostilities, though, shortly afterwards, the disputes between the Emperor and the United Provinces, respecting the barriers and strong towns in the Netherlands, excited the attention and jealousy of France.

France interferes in the affairs of Holland.

Before the late war, a French faction had scarcely existed, or, at least, had not been powerful in Holland; but that event, by detaching Great Britain from the United Provinces, had opened up an opportunity for such a faction to establish itself at the head. This faction consisted of the hereditary enemies of the Orange family; so that in Holland, as in America, the despotic government of France united itself with republicans. As soon as the Emperor extended his pretensions to the navigation of the Scheldt, the Dutch implored the mediation of the King of France, their late hostility with Britain having deprived them of any claim for protection or mediation from that power. At this time, there were two parties at the court of Versailles, at the head of which were the Count de Vergennes and the Marshal de Castries; the former, the favourite of Louis, was, like him, mild, humane, and a strong friend to peace; the latter, supported by the Queen, was, like her, bold, intriguing, and enterprising, and the strong advocate for war. As the mediation of France had no influence with the Emperor, and the Dutch saw themselves threatened with hostilities, in consequence of having opposed his designs on the Scheldt, they applied to Louis for a general to head their armies; and the Count de Millebois was sent to them. Count de Vergennes, hitherto, had opposed any hostile or violent measures; but, at this juncture, in consequence of the encroaching aggressions of the Emperor, he expostulated with the court of Vienna in more free and direct language. At the same time, the armies of France moved by degrees to the borders of Alsace, Lorraine, and the Low Countries; and orders were given to form a camp at Lans of 80,000 men. The Queen of France, though ambitious and warlike, by no means approved of these indications of hostile measures against her brother the Emperor; and therefore endeavoured to bring back the mind of the Count de Vergennes to its habitual feeling of moderation and love of peace; but the Count, though sensible of the state of the finances of France, and therefore desirous, if possible, of averting hostilities, could not brook the idea, that the honour or interests of his country should be sacrificed; and, on the morning when a grand council was to be held, the result of which was to be conclusive with regard to the part France should take, and the Queen desired he would not on that day forget that the Emperor was her brother, he replied, *that* he certainly would not forget, but he must also remember that the King of France was her husband, and the Dauphin her son. Soon afterwards, the Emperor accommodated his differences with Holland, through the mediation of France, and thus the military preparations of the latter were rendered unnecessary.

Alliance between the two countries.

The influence of France at the Hague, was thus considerably strengthened; and the Count de Vergennes did not fail to make use of it for the advantages of his country, by forming a new treaty of alliance. By this treaty, in case Holland was engaged in war, France was to furnish her with 10,000 infantry, 2000 cavalry, 12 ships of the line, and six frigates; and, in the event of a maritime war, or, in other words, in case England and France should recommence hostilities, the United Provinces engaged themselves to furnish six ships of the line, and three frigates. If France were attacked by land, they were either to furnish 5000 infantry and 1000 cavalry, or a proportionate sum of money.

Calonne at the head of the finances.

The internal condition of France was every day becoming more alarming. Monsieur de Calonne was now at the head of her finances. He had already displayed address and talents in the measures that he suggested for the re-establishment of the Caisse d'Escompté. He also established the Caisse D'Amortissement, or sinking fund, the plan of which was recommended by its simplicity. According to it, government were to pay annually into the hands of commissioners, the entire interest of the national debt, together with an additional sum of L.120,000 sterling. By this, it was estimated that annuities to the amount of L.50,000 would be annually extinguished; and in that proportion the sum set apart for the liquidation of the national debt would be increased. In order to secure, as it was expected, the regular application of this sum, the annual receipt of the Caisse D'Amortissement was declared incapable of being diverted to any other object. But it is manifest, that, in a country where the regular expences of the state were far above its income, it would be impossible to raise the additional annual sum requisite for the establishment and operation of a sinking fund. The object of the financiers of France ought to have been exclusively to relieve the existing difficulties, and not by any means to have extended their views and plans to a remote generation. There were besides other causes operating against the success of any plans of finance, which will unfold themselves as we proceed in the history. As the manners and the talents of Calonne were more insinuating and popular than those of Necker, while he was also more accommodating to the necessities or the wishes of the court, he was their favourite; but with the nation at large, he was not so great a favourite as Necker had been. He continued, however, to support himself without being exposed to any considerable degree of odium, till the year 1785, when, by the establishment of a new East India Company, he excited violent censure. The objections urged against this monopoly were brought forward in a style of boldness and freedom, hitherto unusual in France; and, from the substance as well as the manner of them, it was evident that those philosophers who had hitherto confined their speculations on government and political economy to books, were extremely desirous of reducing them to practice. Monsieur de Calonne was by no means in a condition to regard the discussions which this subject gave rise to with indifference; as they plainly indicated, that a body of men who at this time had great influence in France, were decidedly hostile to the measures of his administration. He likewise was convinced, that the re-establishment of the finances was a much more arduous task than he had anticipated; for though France had now been at peace for three years, it was found requisite at the end of each year to supply the deficiency of the revenue by a loan. Still, however, had the rigid economy recommended and pursued by Neckar been persevered in, the expenditure and the income might have been brought more nearly on a level; but large sums were laid out on the fortifications of Cherbourg; and the Marquis de Castries, as minister of the marine, had been profuse in his expenditure. These sums might have been saved, as there was no absolute and pressing necessity either to extend the fortifications of Cherbourg, or to increase the navy. The money required during the dispute between the Emperor and the

A. D. 178

Dutch, for the purpose of placing the French army on a respectable and efficient footing, was more properly laid out.

As the internal resources of France were the only means by which the revenue could be augmented, it became the paramount duty of the ministry, to nourish them with the greatest care and attention. That they did not perform this duty in a conscientious and wise manner, was loudly and generally urged against them, in consequence of the commercial treaty between Great Britain and France in the year 1786. On this subject, strong and unfounded prejudice bore down calm and clear investigation; but, in some respects, it must be admitted, that the framers of the treaty did not sufficiently advert to the protection which the weak and infant manufactures of France required, in order to enable them to rise to an equality with those in England, or, at least, to meet the English manufactures in the markets of France.

Commercial treaty with England, A. D. 1786.

Discontents in France,

The popular mind was now in such a state of discontent and irritation, that the smallest evil made it break out into bitter complaints against government. It may therefore well be conceived, that the edict at the end of the year 1785, for registering a loan of the enormous amount of £3,333,000 sterling, produced violent murmurs. When this edict was presented to the parliament of Paris, they selected a deputation to wait on the King with their remonstrances; but he informed them, that he expected to be instantly and implicitly obeyed; and the ceremony of registering took place the next day, accompanied, however, with a resolution, that public economy was the only genuine source of abundant revenue, and that without it, the necessities of the state could not be supplied, nor public credit and confidence restored. This firmness was highly displeasing to the King; he ordered the records of the parliament to be brought to him, and erased the resolution with his own hand; at the same time declaring, that he expected in future they would communicate, in a loyal and respectful manner, whatever they deemed advantageous to the nation. As the parliament were at variance with Calonne, the King embraced this opportunity of supporting the measures of that minister, which were not to be defeated by their violence or groundless apprehensions. In order more strongly to mark the royal displeasure, one of the members, who had been most active in passing the resolution, was dismissed.

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Calonne at this period seems to have been first convinced of the necessity of assembling the Notables. It is probable, that he expected from them a more ready acquiescence in his views and plans than he had met with from the parliament of Paris; and as these views and plans now went far beyond the measures he had at first proposed and adopted, it was proper they should be sanctioned by a body more numerous, as well as more respectable, than the parliament. He was convinced that the state of the kingdom was such, both with respect to its finances and resources, and with respect to the general feeling of the necessity of some political reform, that farther delay would be dangerous; and he hoped that the assembling of the Notables would remedy the existing evils in the most safe and legitimate mode. He had, indeed, the option of assembling either the States-general or the Notables. The former had not been called together since the year 1614: They consisted of deputies chosen by the three estates, the nobility, clergy, and people at large. To this assembly Calonne had strong objections: In the first place, the election of the deputies, in the agitated state of the country, could not fail to increase the commotion, and to let the people feel too sensibly their own weight and influence; in the second place, the deliberations of such an assembly would necessarily be tedious, and, consequently, the distracted state of the country would be prolonged. But the circumstance which weighed with the minister most powerfully against calling out the States-general, was the apprehension that they would be disposed to carry the reform much farther than he wished; and the impossibility of foreseeing what would be the consequence of putting power into their hands. The Notables, therefore, an assembly which had been occasionally substituted in the room of the States-general, was preferred by Calonne. It consisted of a number of persons from all parts of the kingdom, chiefly selected from the higher orders of the state by the King himself. This mode of selection would render the delegation of power to them perfectly safe, it was expected; while their deliberations would be shorter, and more easily managed by royal influence. The writs for calling together this assembly were accordingly issued on the 29th of December 1786: they were addressed to seven princes of the blood, nine dukes and peers of France, eight field marshals, twenty-two nobles, eight councillors of state, four masters of requests, eleven archbishops and bishops, thirty-seven heads of the law, twelve deputies of the *pays d'etats*, the lieutenants-civil, and twenty-five magistrates of the different towns in France. The total number was 144; and the opening of the assembly was fixed for the 29th of January 1787.

It ought to have been the leading object of the minister, to have laid before this assembly his plans as soon as possible, and immediately after their sanction of them to have dismissed them. This, at any period, would have been the wisest method; but it was more particularly required at a time when Paris was filled with discussions on points that went far beyond the mere re-establishment of the finances, or the reform of acknowledged and gross abuses. When the day of meeting came, however, the minister was not prepared; it was therefore put off till the 7th of February; but, before this day arrived, Calonne fell sick, and the Count de Vergennes died. The loss of this statesman was severely felt by his colleague, as he had entered fully and warmly into all his plans, whereas the keeper of the seals was his avowed enemy, and the minister of the marine department was personally attached to Neckar. The secretary for the household was the creature of the Queen, and, consequently, attached to what was called the Austrian system.

Their first meeting, 22d Feb. A. D. 1787.

Calonne's plan.

At length, on the 22d of February, the first meeting of the assembly of the Notables took place. Calonne laid before it his plan for re-establishing the finances and the public credit of the kingdom, which he prefaced, by pointing out the necessity of adopting it, or some other. He stated, that when he was appointed to the office of comptroller-general of the finances, the deficiency of the public revenue amounted to £3,330,000 sterling. This, it was evident, must be made up, as well as prevented in future, if the finances of the country were to be restored to a proper state: For this purpose he proposed, that a territorial impost, from which no class or order of men should be exempted, should be sanctioned by the assembly; that the clergy, hitherto not considered liable to pay taxes, should contribute in a fair proportion to the exigencies of the state; that the management and receipt of the taxes already existing, should be the subject of minute, impartial, and strict investigation; and that, if these measures were not adequate to the cure of the evil, the demesne lands of the crown should be mortgaged.

If the minister expected that his statement and his plans would be implicitly received by the assembly, or that they would, at the most, only give rise to such a kind of discussion as would preserve the appearance of independent authority in its members, while it did not essentially oppose the minister, he was most grievously mistaken. He had represented the resources of France as very contracted, and her debt as large; and on these grounds he had called upon the assembly to sanction his plans: But before Neckar had retired from the management of the finances, he had published a work, in which he represented France as possessing a surplus revenue of £425,000. It was not to be expected, that the gloomy statements of Calonne would not be contrasted with the cheering statements of his predecessor. Before, therefore, the members of the assembly proceeded to discuss the plan it-elf, they insisted, that there was no necessity for its adoption; and that, if the ministers were honest and able, France might easily, without any sacrifice or additional burden, be extricated out of her present difficulties. These attacks on the ability and honesty of Calonne, were supported principally by the Archbishop of Toulouse and the Count de Mirabeau; the latter a man of brilliant talents, of the most profligate principles and conduct, and who was resolved that his country should, if he could possibly effect it, be plunged into such a state of anarchy, as would give room for the exercise of his talents, and the unrestrained play of his most vicious and dangerous habits.

Calonne's plan opposed.

The minister soon found, that his plan met the approbation neither of the nobility and clergy, nor of the people at large. The ancient nobility and clergy had hitherto been free from taxes; and, as patents of nobility were easily procured, they were eagerly sought after, for the purpose of exempting the possessors from taxation. The nobles, therefore, both old and new, were strongly averse to a plan which should oblige them to contribute to the exigencies of the state; and they were supported in their opposition by the clergy and the magistrates, who also were exempt from taxation. It might, however, have been expected, that the mass of the people would have regarded Calonne as their friend; since, if his plan were carried into effect, they would be relieved from part of their burden. But at this period the people had no means of making their feelings or wishes known; and besides, the measures of the minister, in other respects, had not been such as to command or deserve popular favour and support. He was therefore assailed, unprotected, by the nobility, clergy, and magistrates, who were so blinded by an imperfect and selfish consideration of their own immediate interest, as to refuse to restore public confidence and tranquillity by a trifling sacrifice. In the month of April, Calonne, finding it impossible to maintain his ground, resigned his office, and retired to England.

He resigns.

France again interferes in the disputes in Holland, A. D. 1787.

In the year 1787, the disputes in the United Provinces between the republican party and the Prince of Orange, again opened an opportunity for the cabinet of Versailles to strengthen its interest in Holland; and had not the King of Prussia taken a decided part in support of the Prince of Orange, it is probable that the republicans, aided by the French, would have borne down all opposition. The cabinet of Versailles, however, did not deem it prudent so assist them in an open manner, though they permitted their officers to go into Holland, and even sent tried and experienced soldiers for the purpose of disciplining the burghers and volunteers. Great Britain also, forgetting the conduct of the United Provinces during the American war, or rather, perhaps, ascribing that conduct to the influence of that party which was now endeavouring to destroy the authority of the Stadtholder, fitted out a squadron of men of war, for the purpose of countenancing and supporting the measures of the King of Prussia. Upon this, the French ministry also began to equip sixteen sail of the line at Brest, and recalled a small fleet of men of war which were cruising off Portugal. It was very evident, that a mutual jealousy between the courts of Versailles and St James's had no small influence in giving rise to these hostile indications; but as soon as the power of the Stadtholder was re-established, and, of course, all pretexts for armaments taken away both from Britain and France, each cabinet was anxious to replace things on their former footing. Britain had begun to feel the beneficial consequences of Mr Pitt's measures of finance, and of her reviving commerce; and France felt too sensibly her inability to plunge herself into a new war, if it could possibly be avoided. The navies of both nations, therefore, were placed on the footing of a peace establishment, and harmony was restored between them.

From these momentary and comparatively trifling subjects of uneasiness, the mind of Louis unwillingly reverted to the assembly of the Notables. It was already too evident, that they would not assist in extricating the king out of his difficulties, unless they were recompensed for their interference and assistance, by a compliance with their demands; and it was equally evident, that their demands would go far to reduce the royal authority to that limited condition in which it had been before the reign of Louis XI. Louis, however, had gone too far to recede; and even if he could have receded, and dismissed the Notables, how was he to recruit the finances of the kingdom? It was therefore necessary to gain the good will, or at least to avoid, as much as possible, exciting the discontent and suspicion of the assembly; and, for this purpose, the Archbishop of Toulouse was appointed to superintend the finances, instead of Calonne. But he soon found that it was more easy to object to the schemes which his predecessor had presented, than to offer any thing more satisfactory; and he was under the necessity of again proposing the territorial impost. The objections and opposition to it were now more violent than before, as the assembly plainly perceived that the kingdom was in such a state, as to have placed the sovereign completely in their power. Louis was thus placed in a state of great embarrassment; but, at length, he determined to dissolve an assembly from which he had received no support or advantage, but which, on the contrary, had only increased the difficulties in which he was previously involved. On the dismissal of the assembly, royal edicts were issued for raising money; to these the parliament of Paris objected, in such peremptory language, that Louis was under the necessity of holding what is termed a Bed of Justice, and compelling them to enrol the edicts. In former times, the Parliament would most probably have submitted after this step; but now they were emboldened by the sense of their own power, and the unequivocal symptoms of disaffection, which had spread over the whole kingdom, to protest against the enrolment as a compulsory measure; and to declare that the first person who should attempt to carry the edict into execution, should be pu-

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nished as a traitor to his country. At this crisis, the King acted with unusual decision and vigour. As soon as the discontents and opposition of the Notables began to wear a formidable aspect, large bodies of troops had been gradually brought into Paris; and some of these, a few days after the Parliament had entered their protest, signified to each individual member the King's pleasure, that he should immediately leave Paris, and proceed to Troyes. The Parliament, probably forewarned or apprehensive of this measure, had previously registered their opinion, that no permanent tax could legally be imposed, except by the authority of the three estates of the kingdom; and had, at the same time, urged the necessity of calling them together.

The Parliament banished;

For a short period, Louis endeavoured to proceed without the Parliament, but he found it impossible. He was frugal and economical in his habits and expenditure; but the savings thus effected went but a little way towards the removal of financial difficulties, while they failed in gaining him the confidence or approbation of his subjects. He himself, indeed, was not very unpopular; but the other branches of the royal family, particularly the Queen, and the Count D'Artois, were the objects of the indignation of the Parisians. They could not be but sensible of the danger in which they, as well as the King, were placed; yet they acted in such a manner, as to increase that danger. The time for haughty manners, and tyrannical conduct, was gone bye; yet the Count D'Artois did not accommodate himself to the change of circumstances, but spoke and acted as if the sentiments and feelings of the people, and the influence and authority of the crown, remained exactly the same as they had been when Louis XVI. ascended the throne. The King at last yielded, and recalled the Parliament; a kind of compromise took place between them; Louis gave up the territorial impost and the stamp duty, and the Parliament sanctioned the appointment of the Archbishop of Toulouse to the situation of first minister of state. These concessions, on the part of Louis, however, failed in conciliating the people; being regarded either as the effects of apprehension, and of conscious weakness, or as the giving up of unjust claims. The King also soon found, that the Parliament itself regarded their recal as a triumph, and that they returned still less disposed to submission and obedience; for, about the middle of November, after he had laid before them two edicts, one for a new loan of nearly 19 millions sterling, and the other for the re-establishment of the Protestants in their civil rights, introducing these edicts by a speech, in which he intimated his expectation of obedience from the Parliament, a bold and animated debate took place, which was so offensive to the King, that he suddenly arose, and commanded the edict to be instantly registered. Scarcely had Louis sat down again, when the Duke of Orleans, first prince of the blood, declared this command of the King to be an infringement of the rights of Parliament; and, on this ground, entered his protest against all the proceedings, as illegal and void. Louis merely repeated his commands, and left the assembly. On his departure, the protest of the Duke was formally sanctioned by the Parliament.

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Louis was now more embarrassed than ever; and his frame and powers of mind, as well as his habits, were by no means equal to prompt and vigorous decision, or to persevering and consistant conduct; nor does he seem to have been fully aware of the bad consequences which would result from the display and exercise of a stretch of authority, which interest or prudence might induce him soon to relax. His first action, after leaving the Assembly, was one of vigour and boldness. The Duke of Orleans was banished to one of his seats; and *lettres de cachet* were issued against two of the members of the parliament, who had been most violent in the debate. To the remonstrances of the parliament against those proceedings, Louis at first replied in authoritative language: but about the beginning of 1788, he yielded, and the Duke of Orleans was recalled, and the two members liberated.

Hitherto the parliament of Paris had confined its efforts to opposing the measures of the King; or, when they did advert to the establishment of civil and political liberty in France, it was only in general terms; but they now directed their invectives against *lettres de cachet*, which had, the previous year, been remonstrated against by the parliament of Grenoble. These invectives again excited the severity of Louis; the parliament was surrounded by troops, and the obnoxious members seized. Their language on this occasion was even more bold than it had ever been before; as they did not hesitate to tell the King, that his authority could only be esteemed and supported so long as it was founded on justice. Compared with this opposition to the royal will, the measures of the Notables had been mild and respectful; and Louis therefore resolved to assemble them again. As soon as they met, the keeper of the seals explained his Majesty's pleasure, that a *cour pleniere* should be established; this proposition was favourably received by the Notables, but the parliament of Paris protested against it. This opposition, in connection with some serious disturbances that took place in the capital, at length induced Louis to recal Neckar to the administration.

The Notables again assembled, A. D. 1788.

This minister soon perceived that the royal authority was very considerably weakened since he was in power before, and that he had only the choice of difficult, and even hasardous, expedients. But decision was absolutely necessary; and as it was of the utmost importance for the King to regain the confidence and loyalty of his subjects, the minister strongly recommended that the States-General should be assembled. From the opposition which the parliament of Paris made to this measure, he augured that it would at least serve to diminish their influence.

Neckar recalled.

The principal difficulty respecting the States-General, arose from the opposition of the nobility and clergy to the representatives of the Commons being equal in number to the other two orders united. The Count D'Artois headed the party which contended that the representatives of the Commons ought to be confined to a third in number of the States-General. The opinion of the Duke of Orleans was supported by Neckar, and sanctioned by the King. The number of deputies was fixed at upwards of 1000, and the representatives of the Commons were to be returned according to the population of the different districts of the kingdom.

The States-General.

On the 5th of May 1789, the assembly of the States-General was opened by the King at Versailles. His Majesty's speech was conciliating and prudent; he did not affect to conceal the discontents of the people, while he expressed his firm conviction, that the causes of these discontents, so far as they were real and just, would be removed by the wisdom and patriotism of the Assembly. He no longer used the language of a sovereign, who expected implicit obedience to his will; on the contrary, he expressly represented his power as that of a just king

Their first meeting, 5th May, A. D. 1789.

in the midst of a people faithful and ever devoted to the principles of the monarchy. The speech of Neckar was by no means calculated to strengthen the good effects of the speech of the King; as he represented the assembling of the States General, not as a constitutional right, but as the effect of royal compliance. He thus excited the suspicion and ill will of the third estate, while he did not conciliate those who had all along regarded him as the enemy of the privileges of the other branches of the Assembly.

Disputes between the nobility and clergy and the commons.

A difficulty not unforeseen, arose in the very first meeting; for the nobility and clergy seemed resolved to decide every question by a majority of the orders taken separately, and, as a preliminary step, retired to their respective chambers to verify their votes. To this the commons strongly objected; but as their objections were not attended to, they proceeded to business separately; the nobility did the same; the clergy, however, offered their mediation between the contending parties.

From these proceedings it was too evident that the Assembly was constituted in such a manner, as not to promise unanimity, and consequently that the object of its meeting would not be fulfilled. The distresses of the state, which they were met to deliberate upon and remedy, could not be removed effectually and permanently, until a more equal and productive system of taxation were established. Nor could the discontents of the people be pacified, until the abuses, against which they had lifted up their voice, had been put down; and yet as the nobility and clergy were principally concerned in both these objects, it was desirable that they should manifest a conciliating spirit. Between the period of its first meeting and the beginning of June, several of the clergy, and a few of the nobility, had agreed to act along with the commons; but as the rest were refractory, the Abbé Sieyes, on the 15th of that month, made a motion, the object of which was to declare, that the commons, with such members of the nobility and clergy as had united with them, were the known and acknowledged representatives of the nation. On the following day this motion was carried; and the appellation of *National Assembly* was given to the meeting.

The National Assembly.

Their bold measures;

Their very first measures plainly indicated the spirit by which they were actuated. All taxes were declared illegal, because they had not received the consent of the nation; but so long as the National Assembly sat, they might be levied; the moment it was dissolved, the people were no longer bound to pay them. The public debt was placed under the protection of the honour and faith of the French nation; and a committee was immediately appointed, to enquire into the causes and remedy of the dearth which then afflicted the kingdom.

opposed.

Thus did Louis find, that his authority was in a great measure wrested from him by the National Assembly; and the great body of the nobility and clergy, by their refusal to unite with the commons, likewise saw themselves shut out from power, and their privileges invaded. It was not to be expected that either would patiently submit. On the 21st of June, when the deputies of the National Assembly attempted to enter their place of meeting, the door was shut against them, under the pretext, that preparations were making for the royal presence on the 23d. They immediately retired to a neighbouring tennis court, where they unanimously took an oath to consider themselves as inseparable, and to continue to meet wherever they possibly could. On the following day, many more of the clergy joined them, and M. Bailly was declared president of the National Assembly. On the 23d, the King met the three orders in the grand saloon. He reprobated the proceedings of the commons; and the keeper of the seals in his name declared, that the distinction of the three orders was essential; that the proceedings of the commons had been illegal; and that the saloon should be closed to the public in general. A second and third declaration followed, in which the subjects for deliberation, and the wishes of the King, were pointed out. When his Majesty retired, he commanded the three orders to separate. The nobility almost unanimously obeyed, and most of the clergy; but the commons were firm, and, before they adjourned, agreed to the motion of Mirabeau, "that the person of every deputy should be regarded as inviolable."

The crisis which now seemed fast approaching, was delayed for a short time, by the King's desire of tranquillity. This induced him to recommend the nobility and clergy to join the commons; and the junction accordingly took place on the 27th of June. Some of the members of these orders, however, refused to obey the King; but as they were not numerous, they could no longer hope to oppose the commons.

Feelings of the inhabitants of Paris.

It was not to be expected, that the citizens of Paris should be indifferent in the midst of these commotions; on the contrary, all the points in dispute between the King and the National Assembly were discussed by them with a wonderful degree of boldness; and symptoms began to manifest themselves of a feeling decidedly hostile to the established government. With a few, perhaps, this feeling originated from a calm and dispassionate conviction, that there were gross abuses in the state, which ought to be removed, and which could be removed without endangering the tranquillity of the nation, or altering the fundamental constitution of the kingdom; but with the great majority of the citizens of Paris, this feeling arose from an undefined and vague desire of change, violent in its nature, and uncertain in its means or object. Such being the state of mind in the metropolis, and such the conduct of the National Assembly, it was too evident, that unless the councils of the king were directed with a most uncommon share of moderation and firmness united, they could not extricate him from the impending danger. But no such qualities existed in his councils; he himself indeed was mild and conciliating; but as such, his conduct was only the more calculated to do harm, since those measures which he himself approved and adopted were done away, probably the next day, by the unbending harshness of his advisers. These influenced him so far, as to gain his sanction to the assembling large bodies of troops in the capital and its vicinity. The consequences were such as might have been anticipated. These troops were not sufficiently strong to keep down the citizens, while they were exposed to be insulted by them; commotions took place; and during the irritated state of the public mind, Monsieur Neckar was dismissed from his situation. This was the signal for insurrection in Paris; and the King again yielded, declaring that the troops should be withdrawn, and that the citizens should be permitted to form themselves into military bodies. But this concession was too late; the regular troops and the citizens had already fought; blood had been shed; and the French guards had, in this rencontre, joined the people. The bastile was the first object of the popular hatred and fury; in a short time, not a single stone remained; the governor, who had opposed the people, was dragged to a place of execution, and his head, severed from his body, was carried in triumph through the streets.

Insurrection there

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The King now perceived that his sole reliance must be on the army, since it was absolutely necessary to restore order and obedience before he could go on with his plans of reformation; but the army, which had always been characterised by their extreme devotion to the Monarch, openly declared that they would not fight against their fellow-citizens. No alternative therefore remained for the King, but concession. Neckar was recalled; the King himself returned from Versailles to Paris; and was obliged to submit to the speech of M. Bailly, (who had been chosen mayor,) on delivering the keys of the capital, in which he plainly told him, that the people had that day reconquered their king.

Emigration takes place.

Louis had already signified his approbation of the plan of forming a national militia; or in other words, an armed body, who would obey not him, but the National Assembly; it had been accordingly formed, and the Marquis de la Fayette, whom we have already mentioned as having gone to fight in the cause of American independence, was appointed colonel: this appointment, Louis deemed it prudent to sanction. At this period the more obnoxious members of the royal family, as well as several of the nobility, determined to leave France; this they were induced to do, not merely from regard to their own safety, but because they hoped to influence foreign powers to support the royal cause. Among these emigrants, the most celebrated were the Count D'Artois, the Prince of Condé, and the Marshal Broglio.

The King still pursued his plan of concession and conciliation; corn was brought into the capital, in order to reduce its price there; and corporal punishment was abolished in the army. By these measures the tranquillity of Paris was preserved for a short time; but the provinces were in a state of complete anarchy; the peasantry rose, and destroyed the churches and seats of the nobility with savage fury: the more obnoxious of the nobles were seized and exposed to the most barbarous and lingering deaths.

arbarous ccesses in fferent rts.

The return of Neckar was celebrated at Paris with so much joy, that it was hoped his influence might restore tranquillity and obedience; but he soon found that circumstances were radically and fatally changed during his absence; and his very first attempt to procure a general amnesty was defeated. Fresh commotions arose, and were marked by additional excesses and cruelties. At St Denis, Caen, and Strasburg, the conduct of the populace would have disgraced the most barbarous periods of the most barbarous nations that ever existed; it was no longer the reformation of abuses, even by violent means, that they aimed at; but the gratification of the most diabolical passions. The revenge too, which they took, was, in most instances, cowardly in the extreme; and extended even to those who had been their best friends and greatest benefactors, merely because they belonged to the class of the nobility, or because they endeavoured to bring them back to a sense of their duty and real welfare.

iduct of Nation- Assem-

Had the members of the National Assembly been the enlightened advocates of liberty, and the true friends of their country, they would have exerted their influence, in the first place, and above all other considerations, to the repression of anarchy and the restoration of obedience, from the conviction, that whatever they might decree in their meetings respecting the political or civil privileges of the people, could not be enjoyed by them, till they were restored to a sense of their duties, and of the necessity as well as advantage of obedience and order. But the Assembly, instead of endeavouring to repress the tumults which disgraced the capital and the provinces of France,—instead even of enacting laws which were applicable to the state of the country, and which might gradually have conduced, at once, to restore the privileges and liberties of the people, and to repress their licentiousness;—instead of acting in this sensible manner, they spent their time in discussing abstract propositions, which either were unintelligible, or could not possibly have any practical application to the existing state of the country. Had France been in perfect tranquillity, and every law been passed which was essential to preserve that tranquillity, and to secure the liberty of the subject, such discussions might have been excused, because they would have done little harm, and not have occupied time and abilities which had much more urgent demands upon them; but when the machinery of the state was in complete disorder, and at the same time working with the most mischievous and fatal rapidity, it was absurd and criminal in the highest degree, to be discussing the principles on which it had been, or might be, constructed, instead of repairing its defects. Yet such was the conduct of the National Assembly. The abstract proposition of the rights of man, which, besides being abstract, and therefore improper for the discussion of the Assembly, was not very intelligible, occupied their time and attention at the very period when the smallest reflection, the most limited practical knowledge of mankind, might have convinced them, that the people of France could not be put in possession of their rights with advantage to themselves, or with safety to the community, while they continued so forgetful of their duties, as to give themselves up to anarchy, plunder, and murder.

Abuses reformed.

The other discussions of the National Assembly were on subjects more practical, and therefore more fitted to their character and situation; but even these should have been postponed till they had proved their authority over the people, by restoring order and tranquillity. The feudal system, in all its branches, was abolished; the public burdens were equalized; the most oppressive taxes were repealed; the clergy gave up their territorial rights; and a resolution was passed to inquire into the pensions granted by the court. As the King did not oppose these proceedings, he became popular for a short time, and was honoured with the appellation of the Restorer of the Liberties of France. Indeed, it was now evident, that if he did not yield to the storm, he would be overwhelmed by it, for he had no supporters; even the Swiss and French guards had deserted him.

Could observation and experience have taught the National Assembly the folly of their conduct, in not beginning by repressing the insurrectionary spirit of the people, they would have learnt wisdom by the events of each passing day. In Paris corn was still dear; and the people, let loose from all restraint, were still more goaded on to licentiousness, by this circumstance. In the provinces, the peasantry, taking advantage of the abolition of the feudal rights, plunged into the most dreadful excesses; the nobility were murdered; justice was set at nought; and even the harvest, the means of their own future support, suffered from their blind and ungovernable fury.

Financial distress.

If the revenue of the country was inadequate to its expenditure, when every thing was tranquil, and when no corn was imported, the deficiency must necessarily have been augmented considerably, during the suspension of labour, the importation of corn, and the defalcation of many of the taxes, payment of which was eluded or refused by the refractory populace. Neckar, therefore, found his difficulties increase, while his means of removing them were diminished; for he could not expect, in the disturbed and discontented state of the country, that any financial measures would be well received, or could be rendered productive. He therefore thought it his duty, expressly to point out to the National Assembly, that, when he returned, there were in the royal treasury only 400,000 livres; that the expenditure immensely exceeded the revenue; and that public credit was extinguished. In this state of things, he proposed a loan of thirty millions, at an interest of five per cent.; but the Assembly, in the foolish excess of their mistaken patriotism, decreed, that the interest should be only 4½ per cent.; that no security should be given to the subscribers; and that no period should be fixed for reimbursement. The consequence was, that, in 20 days, little more than two million livres were subscribed; the finances became still more embarrassed, and at length it was deemed expedient to vote a loan of 80 millions, at five per cent. to be redeemed in ten years. They thus went into the contrary extreme; and, by the very favourable terms which they proposed, and the large amount of the loan, gave palpable proofs of the wants of the state, and of their knowledge or suspicion of the inability, or the unwillingness of the moneyed men to supply those wants.

Abolition of tithes.

The next subject which occupied their attention, was the abolition of tithes. That they were a grievance, and detrimental not only to agriculture, but to the cause of religion, was acknowledged by almost all the members; but they undertook to abolish them, before they had well considered by what means this could be effected, so as not to injure any party. They confounded the impropriate tithes with those of the church; that is, they confounded absolute property with what the state had set apart for the discharge of religious duty, and might therefore take away. The Abbé Sieyes on this occasion, supported the rights of the clergy, and the Marquis de Mirabeau opposed them. The debates were long and eloquent; at last, a few of the *curés* having voluntarily surrendered their tithes, their example was followed by most of the clergy. This fund thus supplied, even if it could have been made immediately efficient and applicable, was by no means adequate to the necessities of the state; and Neckar beheld a national bankruptcy approaching. To avert this, as all the regular plans of finance had utterly failed, he addressed himself to the patriotic enthusiasm of the people. The people were, in general, willing, but their means were small, and they made no secret that they expected to be recompenced for their liberality, by a still further curtailment of the royal powers and privileges.

Discussions on the *veto*.

The committee which had been appointed by the National Assembly to lay down the principles of a new constitution, expressly declared that the King ought to have an absolute *veto* on every law. This proposition met with violent and general opposition from the people; and, while it was discussed in the Assembly, numerous guards of militia, and several pieces of cannon, were stationed in different parts of the capital. From the first meeting of the Assembly, all their debates had been carried on in a large hall, into which admission was perfectly free: the consequences, as might have been foreseen, were absolutely destructive of freedom of discussion, as the members, either through fear, or the desire of popularity, were too generally disposed to adopt that side of every question which they knew would meet the approbation of the multitudes who filled the galleries. The month of August was consumed in debates about the *veto*, which at length was indirectly negatived by the decrees that were passed for the formation of the constitution. These decrees were in some respects rational and practical; but they were preceded by a declaration of the rights of men and citizens, so speculative and metaphysical, where it was well founded, as to be of no utility; and in other points calculated to mislead and inflame the ignorant and already maddened populace. The decrees respecting the constitution, went to establish a limited monarchy, and to separate completely the legislative from the executive powers: but it is unnecessary to give the details of this or of any other of the numerous constitutions which were made in France; it is sufficient to notice the leading principles on which they were grounded.

Rise of the Jacobin party.

The mob of Paris proceed to Versailles.

To the most negligent observer, the state of the capital at this period must have appeared very threatening. Parties ran excessively high; and on neither side was there moderation. But the most alarming symptoms were, that a most active and numerous association was evidently forming, who regarded even those who had hitherto taken the lead against the royal party, as lukewarm, and stopping far short of what they ought to have atchieved. On the feelings of the lowest of the mob, this third party operated with wonderful but most mischievous effect. The scarcity which still existed, was ascribed to government. A report that the King intended to leave Versailles, and probably the kingdom, was industriously spread, and the most innocent actions of the royal family were grossly misrepresented. Unfortunately the Queen did not conduct herself with that reserved and prudent caution, which her unpopularity, and the circumstances of the times, absolutely required. At an entertainment, given by the *garde du corps*, to the regiment of Flanders, which had been ordered to Versailles to protect the King, the national cockade, which had been lately adopted, was thrown aside, and white cockades supplied by the ladies of the court. This imprudent behaviour was soon known at Paris, where, while the people were suffering under the pressure of famine, they learned that a splendid entertainment had been given at Versailles, as if to insult their misery, and that the symbol of that constitution, from which they expected the removal of their grievances, had been supplanted by the symbol of that government, to which they ascribed them. The populace were joined by the militia of Paris and the ancient French guards; and the Marquis de la Fayette was informed that they were determined to go to Versailles, to exterminate those who had insulted the national cockade, and even to depose the King, if he did not protect and relieve them. The Marquis employed his influence and authority in vain. An immense number of women of the lowest rank, clamorous for bread, and rather encouraged than prevented by the military, set off for Versailles. As soon as they arrived, they besieged the National Assembly, and, in a manner, compelled them to send along with them, to the King, a deputation of their members. In the mean time, La Fayette, having collected the national guard, also arrived. He first presented himself to the National Assembly, and afterwards went to protect the King and royal family. The Queen was the principal object of the fury of the populace, and a desperate attempt was made on her life; but she, as well as the rest of the royal family, were saved by the interposition of La Fayette:

but they were obliged to promise to leave Versailles, and go to Paris immediately. The journey was dreadful, not only in its actual circumstances, but as a dreadful foreboding of what was to come. Before, around, and behind the royal family, were a mob of frantic women, debauched and drunken, attended and cheered by men, if possible, more diabolical than themselves. The procession was headed by two men, who, with their arms naked and bloody, displayed aloft, on their pikes, the heads of two of the *garde du corps*, whom they had massacred.

The success and triumph of the unprincipled and ferocious party, who were anxious to lay hold of all the power, in order that they might gratify their diabolical passions, was now nearly complete. By having forced the King and the National Assembly to Paris, they had succeeded in overawing them both, and in virtually placing all authority in the mob. In vain did the King declare his willingness to adopt any measure that would benefit the nation; in vain did the National Assembly, while they declared themselves the advocates and supporters of liberty, deprecate licentiousness. Every day beheld their authority tottering, and the influence of the most desperate and abandoned of the inhabitants of Paris increasing. The Duke of Orleans secretly encouraged the licentiousness of the mob; and though, for a short time, he was persuaded by La Fayette to retire to England, yet he soon returned; and, even during his absence, his emissaries were at work, carrying on their measures of anarchy and licentiousness.

The principal proceedings of the National Assembly during the remainder of the year 1789, related to the division of the kingdom into departments, and the confiscation of the church lands. Early in the following year, they suppressed the monastic establishments, and confiscated their lands. These decrees evidently tended to conciliate the people at large: in June the army and navy were in a great measure gained over, or kept firmly attached to the National Assembly, by the passing of decrees for the augmentation of their pay.

mptoms war, D. 1790.

In the mean time, the emigrants from France were active and indefatigable in their endeavours to stir up foreign powers in their behalf; and the proceedings which had lately taken place in Paris and in different provinces, gave them too strong pretexts for urging their interference. It was therefore necessary for the Assembly to provide for the not improbable case of a speedy war; and when M. Montmorency communicated to them the hostile preparations in which England and Spain were engaged, respecting a right of fishery on the coast of America, the question was discussed, "Who ought to possess the power of declaring peace or war?" The debate was long, and conducted with considerable animation and talent: but the time was gone by, when the royal party, however wise their measures, or strong their arguments might be, could reasonably expect to carry their point. On this occasion the triumph of the popular party was complete; and it was decreed that the right of peace or war belonged to the nation.

As the Assembly were sensible that their proceedings were viewed with suspicion and jealousy by foreign powers, they decreed that the French nation would never embark in any war with a view to conquest, nor ever employ their forces against the liberties of any people. Thus was the crown, in a very short time, stripped not only of its unjust and hurtful prerogatives, but also of those which were necessary to give it due and proper weight, and to preserve to the constitution the reality as well as the name of a monarchy.

Hereditary titles suppressed.

On the 19th of June, a motion was made to suppress all hereditary titles, liveries, and coats of arms. This was also carried; and, of all the King's ministers, Neckar alone, a plebeian, bred and born in a democracy, and who had always professed republican principles, advised his Majesty to refuse his assent to the decree.

Civic oath, 14th July.

The French are fond of *spectacle*; and of this fondness it was now resolved to take advantage. The Bastile had been destroyed on the 14th of July the preceding year. As the anniversary of this event was now approaching, it was proposed that on that day a civic oath should be taken. The Champ de Mars, a spacious plain which adjoins the capital, was fixed on for the ceremony. In the midst of it an altar was placed, and around the altar an amphitheatre was constructed, capable of containing 400,000 people. At 4 o'clock in the evening, the Marquis de la Fayette ascended the altar, and took an oath to be faithful to the nation, the law, and the King: the deputies of the regular troops and militia repeated, "I swear." The Marquis was followed by the president of the National Assembly, who took an oath varying in substance a little from that taken by the military; and each deputy repeated aloud, after the president, "I swear." The King also, stretching his arm towards the altar, took an oath to employ all the power delegated to him by the constitution, for the maintenance of the constitution, and the execution of the law.

Neckar resigns.

Neckar had long been convinced that his influence was on the wane, and that, even if he still enjoyed it undiminished, he could do no good, either in restraining the blind fury of political innovation, or in restoring order to the finances; he was besides a vain man; and, as has been already remarked, more conversant in detail than in general principles and comprehensive views. On the 4th of September he gave in his resignation.

Hostile preparations in Germany, &c. A. D. 1791.

The hostile preparations of Germany, Spain, Italy, and Savoy, had, in the beginning of 1791, assumed a character that could leave little doubt they were intended against France. With respect to Germany, the German princes, who possessed territory on the north side of the Rhine, could not be indifferent spectators of a revolution in their immediate neighbourhood, which had stripped the French nobility of all their privileges, and, in many instances, had deprived them of their lives. Besides, the German peasants were not slow in following the example set them by their brethren in France; so that what they had actually suffered, as well as the dangers they apprehended, stimulated the German princes against the Revolution. In their apprehensions of future danger, the other princes, at present remote from the example and influence of the Revolution, were not slow in participating; and these apprehensions likewise took hold of several of the sovereigns of Europe. There were also other considerations which influenced some of them: the Emperor of Germany was naturally anxious respecting the fate of his sister, the Queen of France, who was peculiarly obnoxious to the Revolutionists; and the King of Spain could not behold with indifference one branch of the Bourbons stript almost entirely of regal power, and the King, as it were, the slave of his own people.

The Parisians, alarmed at these hostile preparations, were suspicious that the King was consenting to them; and their suspicions were increased and strengthened by the departure, in the month of February, of his

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aunts from Paris. Nor were they satisfied by the declaration of Louis, that, as the laws did not lay them under any restraint, he did not oppose their departure. They naturally concluded that the King had a design of following them, and of joining an emigrant force, which was now collecting on the borders of Alsace. All his motions were watched with so much jealousy, that, on the 18th of April, as the royal family were preparing to go to St Cloud, a report was spread that they were about to emigrate, and their carriages were immediately surrounded and stopt by the people. La Fayette upon this, called out the national guard, but they refused to act; and he was so much hurt at their refusal, that he resigned his command; nor was he, without a very general and pressing solicitation, prevailed upon to accept it again.

Louis attempts to leave the kingdom;

The suspicions of the people respecting the intended flight of the royal party were well founded; but it was delayed, till it was hoped it might be effected safely and certainly. The Marquis de Bouillée, who commanded on the frontiers, removed the national guards, and replaced them by such troops as he could depend upon; and in the whole of the route which the royal party were to pursue, every thing which could facilitate their escape had been prepared with as much order and secrecy as possible. On the 21st of June, it was ascertained that the royal family had left the capital in such a secret manner, that no doubt could be entertained of their intention of quitting France. Immediately all was consternation and commotion, mixed with unbridled fury, among the populace. The National Assembly were more cool and composed: they declared their sittings permanent, and assumed the government. As the route of the royal fugitives was unknown, messengers were dispatched in all directions. Their fate was not long in suspense. Monsieur and Madame arrived safely at Brussels; but the King, Queen, and Dauphin were arrested at Varennes, within a very short distance of the frontiers. This unfortunate attempt excited in the multitude such an abhorrence of the King, whom they suspected of an intention to join the emigrant army, and to invade France, that his most sanguine friends could now no longer hope he would regain their confidence or loyalty; and this feeling of the multitude was cherished and exasperated by all those, who were determined to destroy even the name and vestiges of a monarchy, and to substitute in its room, either an undefined and speculative democracy, or the unrestrained power of the mob; for about this period, those men began silently and secretly to use their influence, who afterwards plunged France into an unparalleled state of crime and wretchedness.

is stopped.

As the plan for the King's flight had been well arranged, and consequently its success had been anticipated, many of his friends, who had hitherto remained in France, now emigrated. The Marquis de Bouillée, who was one of these, afterwards sent a very foolish and mischievous letter to the National Assembly, in which he denounced vengeance to them, and the utter destruction of Paris, if the lives of the royal family were in danger. He added, that he would conduct the foreign armies into France, and that his letter was but the forerunner of the manifesto of the sovereigns of Europe. As danger from abroad was undoubtedly approaching, the National Assembly considered it their duty to guard against it by every possible preparation; but it was also desirable to rouse the passions of the multitude to such a pitch, as would induce them to come forward, as with one heart, in defence of their country. The letter of the Marquis de Bouillée had in some degree this effect; but their purpose was still more completely answered, by the circulation in France of what was called the treaty of Pilnitz. The authenticity of this treaty has been denied; but whether authentic or not, as it produced a wonderful effect on the French nation, it requires to be noticed. It purported to be a partition treaty between certain of the powers of Europe, by which they agreed to make war on France, and to recompense themselves for the expences of the war, and the restoration of Louis to his full authority, by annexing certain parts of the territories of France to their own dominions. In the mean time, the National Assembly, on the 3d of September, presented the new constitution to the King. For reasons already stated, it is unnecessary to give the details of it, especially as the leading principles on which it is grounded have been noticed before. The King having accepted the constitution, the National Assembly dissolved itself on the 30th of September. From its principal and professed object having been the formation of a constitution, it is generally denominated the Constituent Assembly.

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Treaty of Pilnitz.

Meeting of the second Assembly, Oct. 7.

The next Assembly, which was elected according to the forms prescribed in the new constitution, met on the 7th of October. The members of it were entirely new, as the members of the Constituent Assembly, by their own decrees, were excluded from holding seats in it. One of their first decrees respected the emigrants, who were assembling in considerable numbers on the frontiers of France: the punishment of death was denounced against them, if they should continue thus after the 1st of January 1792. Severe decrees also were passed against the refractory clergy, or those who refused to take the civic oath; but the King refused to sanction these decrees. In order to qualify this refusal, he intimated to the Assembly, that the Elector of Treves, on whose territories the emigrants were assembling, ought to be considered as the enemy of France, unless he put a stop to their hostile preparations by the commencement of the following year. This intimation gave considerable satisfaction, and in some measure, for a short time, restored the popularity of the King. This satisfaction was also increased by the declarations received from foreign powers, which expressed, in cautious, and perhaps ambiguous language however, their wish to preserve peace with France. But it was impossible that Louis could long retain his popularity; he was too much under the influence of those who were regarded with suspicion by the republican party, and the republican party themselves were too eager for an opportunity to censure the King. That this party was gaining strength, at least in the capital, was evinced by a circumstance which happened there in the month of November. At this time the mayoralty of Bailly expired; the candidates were La Fayette and Petion; a very few months before, the popularity of the former was so great, that no person would have wished or dared to have opposed him; but now Petion, a violent republican, was elected mayor by a great majority.

State of parties.

It is evident from this, that the republicans were not only strong, but well organised; in fact, they had held, for some time, their regular meetings; and from the place of their assembling, they had received or assumed the name of *Jacobins*. To oppose them, some of the most celebrated members of the Constituent Assembly formed themselves into a society, which derived its name from the convent of the Feuillans, where they assembled. Among them were Rabaud, Sieyes, Talleyrand, Montesquieu, &c.

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The hostile preparations of the emigrants, and of the foreign powers, still went on; nor were they delayed in the least by the death of the Emperor of Germany, or the murder of the King of Sweden. As the French minister for foreign affairs did not use corresponding diligence and exertions, he was accused, even during his absence, by Brissot, apprehended, tried at Orleans, and executed. The management of affairs was next placed in the hands of those, who would not fail to make all due preparation for the hostilities which threatened France. Dumourier was appointed minister of war, Roland minister of the interior, and Claviere minister of finance. This completed the triumph, and established the power of the republicans. One of the first acts of this party was to confiscate the property of the emigrants; their next was to declare war, on the 20th of April, against the king of Hungary and Bohemia, in consequence of the Imperial minister demanding the restoration to the German princes of their feudal rights; the restoration of Avignon to the Pope; and that the neighbouring powers should have no reason for apprehension, from the weakness of the internal government of France.

War declared, April 20, A. D. 1792.

State of the capital and of the army.

The French armies immediately invaded the Austrian Netherlands; but the plan of the campaign was contrived with so little foresight or wisdom, and, from the want of discipline and experience in the troops, so miserably executed, that it was productive of no advantage to the French. Indeed it was evident, that unless their troops were more obedient to their officers, they would do more mischief to the cause of France than to that of the enemy; and yet such was the state of the public feeling, both in the army and at Paris, that the evil seemed more likely to increase than diminish. In the capital, party spirit was very violent; but the Jacobins were evidently gaining ground; and the measures they adopted for increasing their own influence with the people, and diminishing that of their opponents, could not fail of effect. They circulated reports of intrigue and conspiracy in favour of the enemies of the country; the mob, credulous, easily alarmed, and now accustomed to regard the aristocratical party as decidedly hostile to their interests, as well as the lawful objects of their vengeance, rallied round the Jacobins, and supported, in a violent and tumultuous manner, their most extravagant propositions. For some time the King yielded to them; but, like all his former conduct during the Revolution, after having given them his countenance, and thus increased their power, he altered his conduct, and, when it was too late, resolved to oppose them. The ministry were dismissed, except Dumourier, who, by being thus excepted by the King, became an object of suspicion with the Jacobin club; he therefore resigned his office, and joined the army. About this time, Marat, afterwards so infamously notorious, appeared on the stage, and, by his inflammatory writings and harangues, contributed much to increase the unpopularity of the king. On the 20th of June, an armed mob marched through the Assembly, under the pretence of presenting petitions; they afterwards, to the number of 40,000, surrounded the Thuilleries, and insulted the king. As soon as these disgraceful events were known in the army, La Fayette left it, and presented himself at the bar of the National Assembly, where he expressed the indignation of the troops, and called upon the Assembly to prevent the repetition of such scenes, by punishing the promoters of them, and especially by dissolving the factious clubs. But the power of the Assembly was vain against clubs supported by the most numerous, the most desperate, and the most worthless part of the population of Paris; in them, in fact, was centered the government of the capital, or rather in the Jacobin club, which ruled and moulded them at its pleasure.

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To these dreadful internal evils was now added an approaching invasion. The King of Prussia, in conjunction with Austria, was marching against France with an immense force; while the French armies were comparatively few in number, and by no means equal to their opponents in respect to the discipline and obedience of the soldiers, or the talents and experience of the officers. But their deficiencies, in these respects, it was hoped, would be more than compensated by their enthusiasm, and by the co-operation of the people. These, however, it was necessary to rouse, and for this purpose the Assembly ordered a proclamation to be made that the country was in danger. This object, however, was more effectually accomplished, by a manifesto, issued by the Duke of Brunswick, as commander of the invading army, at Coblentz, on the 25th of July. In this manifesto, destruction to Paris, and the execution of all who resisted, were denounced; and the safety of the royal family was declared to be the only condition on which the capital, or the National Assembly, could possibly escape the severest vengeance of the allied powers. The immediate consequence of this imprudent and impolitic manifesto, was the union of all parties, for their mutual defence, and the support of what they conceived to be the will of the nation, and the independence of France. However they might differ and quarrel among themselves, all felt and acted on the necessity, at the present moment, of opposing the allied powers, who entered France with such declarations of vengeance. The friends of the King soon fatally experienced the extent of mischief to him and his cause, which this manifesto produced. The republicans, long anxious for his deposition, had now too good an opportunity to be neglected;—for who, thought they, would dare to defend a King, who was such an enemy to France, as to have his safety put in competition with its liberty and independence? But it was necessary, even yet, to proceed with caution in the deposition of Louis: the republicans could not expect that the National Assembly would willingly agree to it. They had accused La Fayette before it, and he had been acquitted; and hence they inferred, that their measures respecting the King would not be well received by that Assembly; it was therefore their object to excite the worst passions of the populace against him.

Manifesto of the Duke of Brunswick, 25th July.

In Paris, at this time, there were too many, who might easily be made the zealous instruments of the worst of crimes; for, besides the mob of the city, 15,000 Marseillois had arrived at the period of the confederation, on the 14th of July, not the least behind the most unprincipled and ferocious of the Parisians in their hatred of royalty and order, and in their disposition to excite disturbance, and to commit murder. With these, and the mob of Paris, the republicans intrigued, and the friends of Louis were not long in perceiving that his life was in danger. The palace, therefore, was guarded by a number of gentlemen, by the Swiss troops, and by 12 pieces of cannon. Mandat, the commander of the national guards, was at their head. At midnight, on the 9th of August, the tocsin sounded, and the drums beat to arms; but the republicans knew that while Mandat lived, their efforts against the life of the King would be unavailing; they therefore contrived to persuade him to leave his post, and come to the commune, which was entirely composed of their own friends; and as he was leaving the hall, he was shot, and Santerre appointed to command the national guard in his place.

Massacre of the 10th of August.

On the 10th of August, Louis found himself placed in such a perilous situation, in the palace, that he sought protection in the National Assembly. Immediately after he left the Thuilleries, the insurgents, to the number of 20,000 men, attacked the Swiss who guarded it: a bloody combat ensued; but the Swiss were overpowered, and most of them massacred. The republican party, now strong in the success which had attended their first efforts, and in the terror which they had excited, resolved to push the execution of their favourite object immediately; the royal authority was suspended; the nation invited to choose a convention; commissioners sent to the army; and the royal family imprisoned in the Temple.

Royal family imprisoned.

Flight and confinement of La Fayette.

The influence which La Fayette possessed with the army, it was hoped, by the friends of the king and of justice and order, would preserve them loyal and obedient; but they were not to be depended upon, and La Fayette judged it prudent to leave the camp, soon after intelligence of the transactions at Paris had arrived, and to seek his safety in flight. He escaped from his own troops, but he was made prisoner by the enemy, and detained in Austrian and Prussian dungeons for several years. The commissioners now found no opposition to the authority of which they were empowered to exercise over the army; but were received with respect by Generals Dumourier, Biron, Montesquieu, Kellerman, and Custine. Dumourier, having removed the suspicions formerly entertained of him by the republicans, was appointed commander-in-chief, on the flight of La Fayette. This general was at the head of about 17,000 men, and, with this inadequate force, his object was to watch, for he could not hope to oppose, the progress of the allied forces. These had entered France so numerous and well equipped, that the conquest of that country seemed certain and near at hand. The Duke of Brunswick had 50,000 Prussians; there were 15,000 Austrians under Clairfait; and the Hessians and French emigrants raised the total force to 90,000 men. Their success at first was proportioned to their strength and their hopes. Longwy and Verdun surrendered, and Paris was already in alarm.

The allies enter France.

Massacres of the 2d and 3d of September.

This moment of alarm was not to be overlooked by the Jacobin party,—it was too favourable to their views. They declared that the safety of the country, and the destruction of foreign foes, could not be accomplished, while there existed in Paris so many domestic enemies of the people. The most horrid massacres accordingly took place, at which the forms of justice were either entirely neglected, or attended to in such a manner, as to render the proceedings still more repulsive to humanity. For two days, the mob, under the direction of Marat, Roberspierre, and Danton, who now led the common council, had the entire possession of Paris; no person besides durst stir out of their house; the national guards at this crisis seemed disposed to interfere, but Santerre was too strongly attached to the violent Jacobins to repress cruelties which they had organized and directed.

The massacres did not cease, nor was even the appearance of order and tranquillity completely re-established in the capital, till intelligence arrived that the allies had commenced their retreat out of France. For some time after the reduction of Verdun, they had advanced with little or no opposition; but as soon as Dumourier had organised his army, he opposed considerable obstacles to their farther progress, and some battles were fought, in which the French behaved with great coolness, and evidently shewed that they were improved in discipline. Notwithstanding this, however, and the additional circumstance, that the troops under his command were much increased; Dumourier would not have been able to save his country, had not sickness and famine attacked the Prussians. The former originated from the soldiers eating large quantities of fruit, and from the unusual wetness of the season; the latter took its rise from the inhabitants absolutely refusing to carry provisions to the camp of the enemy. It has been suspected that, even in spite of the reduction in the strength and spirits of his soldiers, which sickness and famine produced, the Duke of Brunswick might have driven the French army before him, if the King of Prussia had continued firm to the cause of the allies. However this may be, after a truce of eight days, he commenced his retreat: He was not pursued, but Verdun and Longwy were retaken, and Thionville, which had been gallantly defended by General Wimpfen was relieved. The Austrians were not more successful than the Prussians; for after besieging Lisle for a fortnight without the least prospect of reducing it, they raised the siege. On the side of Savoy, the French were the invaders, and they were received by the people with great joy and enthusiasm. The success which had attended the defence of their own territories, made them forget that they had declared they would not invade the territories of other nations: not only was Savoy invaded, but Spires, Worms, Mentz, and Frankfort were attacked and taken before the close of 1792. The last place, however, did not remain long in their possession, as it was recaptured on the 2d of December in that year. In the Netherlands, the French were still more successful. On the 6th of November, Dumourier attacked the Austrians, who were strongly fortified on the heights of Jemappe. The battle was most obstinate and bloody, but French enthusiasm, joined to superior numbers, succeeded; and this victory decided the fate of the Austrian Netherlands.

The allies retreat.

Success of the French.

National Convention.

In the mean time, the National Convention assembled; and as the republican party were by far the most numerous in it, and were besides sure of support from the Parisians, they proposed, on the very first day of the meeting, the eternal abolition of royalty in France. This was carried by acclamation. The next day it was decreed that all acts should be dated by the year of the Republic; and the appellation of citizen was universally adopted. Still, notwithstanding these foolish and mad acts, there were some men in the convention who did not unite the utmost profligacy of principle and depravity of conduct with their folly and madness. These were the *Girondists*, or *Brissotines*; the most celebrated and respectable of whom were Condorcet and Brissot. The other party were denominated the *Mountain*, because the members of it usually sate on the upper seats in the convention; of these, the most powerful and infamous were Danton, Roberspierre, Marat, and Collot D'Herbois. The Girondists were anxious to punish the perpetrators of the massacres of the 2d and 3d of September; but their motions to this effect were always eluded by the Mountain party, who had been

Royalty abolished.

State of parties.

chiefly instrumental in these massacres, and looked forward to their repetition as the means of intimidating their opponents, and establishing their own power. In October a decree was passed, that all emigrants when taken should suffer death; and in the following month, the Convention declared, in the name of the French nation, that they would grant fraternity and assistance to all people who were anxious to be free; and the generals were ordered to give assistance to all such. On the 11th of December, Louis was ordered to the bar of the Convention; and the act of accusation being read, he was required by the President to answer to each separate charge. These charges were very numerous; some of them were of a frivolous nature; others related to acts done either before the Revolution had defined and limited the royal authority, or in conformity to the constitution which had been established. Besides, that constitution had declared the King's person inviolable. There were, however, it must be confessed, some charges, which were more relevant, and better founded. These related to the connection that the King kept up with the emigrants and with foreign powers; but in defence of him, in this respect, it may be fairly urged, that his situation was such, that no wisdom, no purity of conduct, could have carried him through, free from suspicion and personal danger. What the legislative bodies, or the French people through them, declared to be the constitution one day, was set aside the next; so that the King, seeing a total want of system, and even of principle in the conduct of those who had wrested the royal power from him, and the adoption of measures which threatened not only his own safety, but the tranquillity and happiness of France, ought not to be severely condemned if he looked to foreign support.

Trial of Louis XVI.

After he had replied to the various charges, he was allowed to nominate his counsel. On the 26th of December, his defence was read at the bar of the Convention; and on the 16th of January 1793, after a discussion of 34 hours, the punishment of death was awarded by a small majority. On the 21st, the execution took place.

s execu- n, 16th nuary, D. 1793.

The weakness of Louis's mind, which had displayed itself so frequently and so fatally during the Revolution, disappeared when his misfortunes reached their height; then his whole conduct was firm, composed, and dignified; and he met his fate in a manner which surprised and awed even his enemies.

In the course of this year, France was at war with all Europe, except Sweden, Denmark, Switzerland, and Turkey. The grounds and operations of the war between her and Great Britain are given in the article **Britain**, and therefore need not be repeated here.

eral war ust ice.

After the conquest of the Austrian Netherlands, Dumourier advanced towards Holland: but he did not conduct his operations with judgment; for, dividing his forces too much, he was obliged, after advancing as far as Gertruydenburg, to retreat before General Clairfait with a considerable loss. After experiencing another defeat, towards which it is suspected his own treachery contributed, 6000 of his troops left the army, and went home to France. Their representations, and other circumstances, induced the Convention to send commissioners to the army; and Dumourier, finding that his troops refused to act with him, joined the Austrians. On the 8th of April, at a congress of the combined powers held at Antwerp, it was resolved to invade France for the express purpose of conquest. This resolution was immediately begun to be carried into execution. The Austrians advanced; and, after five different engagements with the French under General Dampier, in the last but one of which he was killed, they succeeded in reaching Valenciennes, and commenced the siege of it. About the same time, the Prussians having repulsed the French army under Custine, laid siege to Mentz. The advantages and progress of the allies created great alarm in Paris, but were not unacceptable to the party of the Mountain. Their object was the destruction of the Girondists; and to effect this, nothing else was necessary but to render them obnoxious to the people, as the enemies of liberty, and the friends of the allied powers. The Mountain party, on all occasions of violence and injustice, used as their instruments the mob of Paris, which was now regularly organised for that purpose. The capital was divided into forty-eight sections, and each section had its commune, or common hall, in which the most impudent and unprincipled directed the proceedings. On the 15th of April, the communes of all the sections petitioned the Convention, that the leaders of the Girondist party should be impeached and expelled. The Girondists retaliated by impeaching Marat; but he was acquitted. This was the prelude of their fall. The Convention was now no longer an independent body, but was overawed by the populace and the Mountain party. The latter, however, were not so powerful in the provinces as in Paris. Most of the southern departments declared the Mountain party outlawed, and broke out into open revolt. The northern departments, in general, adhered to them. Soon after their triumph, they lost one of their leading members,—Marat, who was stabbed by Charlotte Cordé, a woman who came to Paris for that purpose, and who gloried in the execution of a deed, which she thought the cause of freedom and of her country called upon her to perform.

tions Ne- nds.

Alarm at Paris.

Marat stabbed by Charlotte Cordé.

In a fortnight after, the Mountain party gained the ascendency over the Girondists. They framed a new constitution, but it was never put in practice. They also established, or at least gave more vigour to the revolutionary tribunal, the object of which was to try crimes against the state in the most summary and arbitrary manner.

The allies, in the mean time, did not derive so much advantage from the distracted state of France as might have been expected; for, however the French might be divided among themselves, they seemed resolved that no foreign power should interfere in their quarrels, or trespass with impunity on their national independence. Valenciennes held out till the 27th of July, and Mentz nearly as long. The possession of these places seemed to open a direct and easy road into the heart of France. But success produced its usual consequences; the allies could not agree in their future plans, and on this account divided their forces. Unsuccessful attempts were made on Dunkirk, Cambray, and Bouchain. Prince Cobourg was repeatedly attacked by the French under Jourdan: The French soldiers, animated by the presence of commissioners from the Convention, stimulated by spirituous liquors, which were supplied them by crowds of women who attended the army for this purpose, and to carry off the wounded, and supported by a formidable and well-served train of artillery, were irresistible. The

The allies are unsuccessful.

Austrians [illegible] and [illegible] Flanders was again invaded and [illegible] by the French.

[illegible] when they were victorious on their [illegible] their enemies, a civil war raged in different parts [illegible] Lyons, Marseilles, and Toulon, [illegible] of the Mountain party, and [illegible] Convention, who were completely subservient [illegible] and interests of this party. On the [illegible] of August, Lyons was attacked by the conventional [illegible] and though soon reduced almost to ruins, it did not surrender till the 8th of October, when its walls and [illegible] were razed to the ground, and an immense number of its citizens destroyed, by firing grape shot among them; the usual mode of execution by the guillotine being too slow and easy a death for the voracious cruelty of the conquerors. Marseilles, terrified at the fate of Lyons, submitted; and Toulon put itself into the power of Lord Hood, who, however, was soon obliged to evacuate it.

This civil war was between two parties, each of whom was friendly to the revolution; but the civil war in La Vendée was of a different character. In this district of France, the Bourbons had numerous and powerful [illegible]. Divided from the rest of France in some degree by its situation, and much more by the difference of the manners, language, and habits of the people, La Vendée had not participated in the change of opinions which had produced the revolution. Into it, as a secure retreat, many of the priests who had refused to take the [illegible] had fled, and as the inhabitants were superstitious, the priests did not fail to call in the aid of religion to the cause of the Bourbons. At first, the insurgents in La Vendée were rapidly successful; they besieged Nantes, and even threatened Paris; but after a tedious war, in which the most dreadful cruelties were committed on both sides, they were reduced to apparent [illegible] submission.

The [illegible] contest between the allies and the French, in the months of October, November, and December of this year, was on the Rhine. As the latter did not deem themselves sufficiently numerous to oppose their enemies, they had erected very strong fortifications at Weissembourg on the Lauter. On the 13th of October, general Wurmser made an attack upon them with all his force, and notwithstanding their strength, he succeeded with [illegible] in driving the French from their lines; [illegible] they retreated to Hagenau; hence also they were driven, and they were subsequently defeated on [illegible]. The design of the allies to conquer [illegible] of France for themselves, was now manifest, [illegible] Wurmser refused to accept the surrender of [illegible] to his Imperial Majesty. As the defeats which the French had suffered were ascribed to [illegible] or to a want of enthusiasm, commissioners were sent by the Convention to the army, who, by the [illegible] measures, as well as by the doctrines [illegible] to the common soldiers, succeeded in [illegible]. This effect, however, must [illegible] to the numerous reinforcements, which the [illegible] adopted by the convention supplied [illegible] French armies, the nature of which will be af[illegible] experienced [illegible] of the army op[illegible] the commissioners; [illegible] advance and success [illegible] the French became the assailants. Not only the Austrians, but also the Prussians, were defeated in all quarters; they could not withstand the immense numerical superiority, aided as it was by the maddening enthusiasm of the French, even in their strongly fortified redoubts at Hagenau, Rheishoffen, Wrotte, &c.; from almost all of these they were driven at the point of the bayonet. Generals Hoche and Pichegru directed these wonderful atchievements of the French. The campaign terminated in this quarter by the reduction of Spires and Fort Louis.

The allies defeated.

We have already alluded to the means by which the French armies were supplied with such a great numerical superiority, as to compensate, in some degree, for their want of experience and discipline: it will now be proper to explain them. As the Convention had completed the business for which they had been elected, viz. the formation of a constitution, they ought to have dissolved themselves; but under the pretext, that, in the state of France, their dissolution, and the election of a new assembly, might be dangerous, the Mountain party, which was still triumphant, determined that it should continue till the end of the war. They also succeeded in establishing what was called a *revolutionary government*, the principal engines of which was the committee of public safety. This superintended a number of inferior committees; and united in itself a wonderful degree of secrecy, dispatch, skill, and energy. It corresponded with all the Jacobin clubs throughout France, and sent commissioners, with unlimited powers, into all parts of the kingdom. It is evident that this form of government possessed wonderful means of carrying all its measures into complete effect; and, as its members were actuated by one sole motive—that of establishing their peculiar principles,—these means were never neglected through inattention, or sacrificed to interest. In short, at this period, the whole population of France, with all its corporeal and mental powers, stimulated by the most wild and energetic enthusiasm, was directed by a body of men, who knew all the resources of the state, and who exercised their unlimited and almost unquestioned authority, with a degree of talent, vigilance, secrecy, activity, and zeal, never perhaps before combined. They were despotic, not less by the power which they actually possessed, than by the feeling which actuated France; for such was the abhorrence of seeing their country overrun by foreigners, such the desire of rendering what they conceived to be liberty triumphant, that the people almost offered themselves to the operation of those measures, which, with different feelings, and under different circumstances, they would have opposed as arbitrary and tyrannical. Thus the decree for placing France in a state of requisition, by which all unmarried citizens, from 18 to 25, were ordered to join the armies; while the married, the aged, and even the women and children, were to be employed in various ways in the service of their country, by forging arms, making tents and clothes, attending the hospitals, preaching hatred against the enemies of the republic, &c. was not opposed; so far from this, it produced all the effects which the committee of public safety, (from which it originated,) anticipated and expected.

A revolutionary government established.

The Mountain party having thus succeeded in raising the whole population of France against their enemies, and in securing victory by the numbers and enthusiasm of the armies, resolved to destroy the Queen and the Girondist party. Against the former accusations were brought so abhorrent to human nature, that even the most depraved

The Queen and Girondists executed.

of the Mountain party were shocked at their tendency: after a mock trial, she was executed on the 16th of October. On the 30th of the same month, Brissot and 20 othérs of his party were executed; and the Duke of Orleans, who united perhaps a greater degree of personal and political depravity, than any man with whom the revolution has cursed France, was afterwards put to death, by that very party whom he had materially contributed to bring forward to serve his own purposes, and who now accused him of having aspired to the sovereignty from the commencement of the revolution.

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As soon as the Mountain party had got rid of their opponents, they abandoned themselves to the most extravagant and most dreadful excesses. It seemed, in their mad and blind rage for innovation, as if they thought they could utterly alter, not only the constitution of society, but also the very structure of the human mind; and that they were resolved not to rest from their labours, till they had peopled France with a race of beings devoid of every feeling, principle, or habit, which can dignify or console mankind. On the 7th of November, Gobet, archbishop of Paris, with several other clergymen, renounced the Christian religion in the hall of the Convention; and a decree was afterwards passed, that the only French deities should hereafter be Liberty, Equality, and Reason. The Parisians, however, were not so utterly profligate as to go along with the Convention in this respect; and Roberspierre increased his popularity, by supporting religious worship.

In the beginning of 1794, the proposition of the allies *provisionally* to acknowledge the French republic, was rejected by the Convention. Possessed of such an immense machine as the whole population of France, which they wielded at their pleasure with most wonderful talent, and which they had already seen produce the most astonishing effects, it was not to be supposed that, in the moment of victory, the Convention would be disposed to treat with the allies, on the ambiguous condition of provisionally acknowledging the republic. Resolved therefore to persevere in the war, and having completely succeeded in recruiting the armies, the Convention turned their thoughts to the state of the finances. Soon after the commencement of the revolution, paper money, called *assignats*, had been issued; but as these had suffered depreciation, both from the uncertainty with respect to the fate of France, and from the immense issues of them, a law was passed establishing a *maximum*. This, however, it was soon discovered, increased the evil; it then became necessary to support the value and credit of the assignats, by the sale of the lands belonging to the church, and to the emigrants and persons condemned by the revolutionary tribunals. The churches were plundered of their gold and silver; even their bells were melted and cast into cannon. In order still farther to supply the want of money, the personal labours of almost all classes were put in requisition. The materials for making gunpowder were perfected and supplied by the chemists: immense numbers of muskets and cannon were manufactured and cast. The whole agricultural produce of the country was seized by the government, who distributed it to each district according to its population.

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1794.

Yet these very men, who seemed to have but one soul, when they acted for the defence of France, were divided into two most implacable parties. Roberspierre was at the head of one; Danton of the other. Roberspierre triumphed, and by the middle of April all his most active opponents had suffered death. His own fate, however, was not far distant; for, on the 27th of July, several members of the Convention whom he meant to have sacrificed, (among whom the most enterprising was Tallien,) accused him of tyranny: his arrest was decreed, and on the next day he was seized and executed. To him the Moderate party, as they were termed, succeeded; who, at the same time, that they stopt short of his atrocities, were undoubtedly inferior to him in talent, activity, and vigour; so that had not the great machine of the army been so admirably constructed, and so well supplied by Roberspierre and his party, it must have fallen in pieces, or at least worked with diminished effect under his successors.

Execution of Roberspierre.

The allies being now convinced that the French not only could bring into the field larger armies than they expected; but that their generals possessed a very considerable degree of skill, and their troops steadiness and discipline, as well as enthusiasm, prepared to open the campaign of 1794 with such a force, and on such a plan, as, in their opinion, could not fail to render them generally and permanently victorious. Their force amounted to upwards of 180,000 men, consisting of Dutch, Germans, and English, divided into six armies; and their plan was, by getting within the frontier towns of France, to cut off their enemies from the interior. At first they met with some success; but the numbers which the decrees of the committee of public safety poured into the French armies, and the enthusiasm and ardour with which even these raw troops were inspired, in a short time not only deprived the allies of the fruits of their victories, but obliged them to act entirely on the defensive.

Campaign of 1794.

Pichegru, especially, was eminently successful in maritime Flanders: Ypres surrendered to him, Charleroi was taken by Jourdan, who afterwards defeated the Austrians at Fleurus. These misfortunes compelled the allies to retreat in every direction; and the French beheld themselves advanced, victorious, to the confines of Dutch Flanders. On the Rhine, their success was equally great, and from the same causes: before the end of July, the Palatinate was in their possession. In the battles by which these conquests were atchieved, they indeed lost immense numbers of men; but their leading principle was to bring up superior forces every day till their object was accomplished; and thus acting on their enemies with a body, not only of greater weight, but of more rapid motion, they bore down all opposition.

Great successes of the French.

The only cases in which they were unsuccessful this campaign, were in Corsica, and in their rencontre by sea with Lord Howe; the circumstances of both of which have been detailed in the History of BRITAIN.

From the pause which the French army made, when it had advanced to the confines of Dutch Flanders, it was at first supposed that they did not mean to invade the United Provinces; but after a short pause, Pichegru advanced, and the allies retreated before him, first across the Maese, and afterwards across the Rhine. On the 7th of November, Nimeguen was occupied by the French, when they again paused in the career of victory. On the borders of Spain they were equally successful; the Spaniards were unable to stand before them, and the greater part of Navarre fell into their power, while, on the east side of Spain, Catalonia, by the conquest of Rosas, was left totally undefended.

Tumults in Paris.

It is now time to look to Paris, at once the scene of constant intrigue, and the mutual massacre of parties, and the source whence all the victories of the army flowed. The Jacobins, though defeated, were not dispirited or inactive: they formed a most dreadful plot to regain their power; and this plot, as usual, was to be carried into execution in Paris, for whoever ruled Paris ruled the kingdom; and in the most profligate districts of Paris, for hitherto whoever ruled there, ruled the capital. The hall of the Convention was surrounded, on the 20th of May 1795, by immense numbers of abandoned and desperate women, who demanded bread, and the constitution of 1793; and the members were compelled to retire, till General Hoche with the military, dispersed the insurgents. The Jacobins, however, returned to the charge in the evening; and by pointing some pieces of cannon against the hall of the Convention, intimidated the members into a promise that bread should be supplied, and the constitution of 1793 restored. The troops again came to the relief of the Convention; and, by attacking the suburb of St Antoine, the great focus of rebellion, they succeeded in reducing the insurgents, and in restoring the authority of the Convention. In the south of France, where the Jacobins also endeavoured to regain their power, they were not more fortunate; so that the Convention might have established themselves firmly, had they been possessed of that commanding talent and energy, which the state of France, both at home and abroad, at that time, imperiously demanded. But they were deficient in these respects; and their deficiency they were anxious to compensate, by the establishment of a new constitution. The plan of this constitution was laid before the Convention, by the committee appointed to frame it, on the 23d of June. According to it, the legislature was to be composed of two assemblies; and the executive power was to be entrusted to five persons, who were to be called the *Executive Directory*. This plan was not received with much approbation at Paris; and an especial provision made by the Convention, that at the approaching election, the electors should be bound to return two-thirds of the present members, or, if they did not, that the Convention themselves might fill up the vacancies, gave very great dissatisfaction. In this emergency, the Convention endeavoured to strengthen themselves against the citizens of Paris, by an union with the Jacobins; and by this union, and the assistance of the troops in Paris, which were placed under the command of Barras, Brune, and Bonaparte, the refractory citizens were compelled to submit to the Convention; but the consequence was, that the Jacobins regained their ascendency.

Executive Directory established.

Members of it.

On the 27th of October, the Convention was dissolved, and the new legislature began to act. Their first measure was the election of the Executive Directory. Sieyes, Barras, Reubell, La Reveillere Lepaux, and Letourneur de La Manche were chosen. Sieyes, however, declining the honour, Carnot was appointed in his place. All the members of the Directory except La Reveillere Lepaux, had been connected with the Mountain party.

At the commencement of the campaign of 1794, the King of Prussia had received a subsidy from Britain, on condition that he brought into the field an army of 60,000 men; but as this army never arrived, it was suspected that he was about to make peace with France. This suspicion was confirmed; for on the 20th of April, 1795, a treaty of peace with him was ratified by the Convention. Shortly afterwards, the Kings of Sweden and Spain, and the cantons of Switzerland, also concluded a peace with France; and towards the end of August, several of the German princes followed their example. The rest were on the point of acting in the same manner, when victory began to desert the French standard.

Peace with Prussia, A. D. 1795.

Before this reverse, however, the military successes of the French had been very great. We have already mentioned, that, after the reduction of Nimeguen, their army halted in its career of victory. It is probable that they would not have invaded the province of Holland at this season of the year, (the winter of 1794-1795) had not the frost, setting in with uncommon severity, opened for them a safe and easy passage over the ice of those very rivers and lakes, which it was hoped would have served as a secure protection. The allies in vain attempting to oppose their progress, they took possession of Amsterdam, without resistance, on the 16th of January 1795. They were well received by the people, and increased their influence and popularity by the abolition of the Stadtholdership.

Holland subdued.

Soon after this conquest, the Diet of Ratisbon seemed disposed for peace. The allies, instead of overrunning and dividing France, as they had planned and expected, beheld the republic increased by an additional population of nearly 14 millions; while in the course even of the campaign of 1794, and before the conquest of Holland, the French had taken 2000 pieces of cannon, and 60,000 prisoners. The wish of the Diet, however, notwithstanding these wonderful successes of the French, and the probability that they would continue, was not met either by Britain or Austria. The former was still successful by sea; and hoped, by nourishing and supporting the royalist party in La Vendée, to accomplish that which the allied army had failed in effecting; but the most disastrous expedition to Quiberon extinguished her hopes in that quarter.

Austria directed her efforts with more wisdom. By the middle of June, the French were in possession of the whole left bank of the Rhine, except Mentz. In August, Jourdan crossed this river, in order to besiege Mentz; while Pichegru succeeded in gaining possession of Manheim. The Austrians having been driven back, the siege of Mentz was begun; but Jourdan was soon obliged to give it up, in consequence of a defeat which Pichegru experienced from General Wurmser. It was now necessary for both the French armies to recross the river; and after they had effected this, and the Austrians had recovered Manheim, an armistice for three months was agreed too.

In the mean time, the Directory and the Jacobins were continually at variance, and, as usual, each endeavoured to enlist the citizens of Paris in their favour. The more respectable classes were decidedly inclined to support the directory; but the mob, and the *Legion of Police*, as they were called, consisting of 10,000 men, were as zealous for the Jacobins. Relying on these, the latter attempted to carry into execution a plot, according to which, the members of the Directory were to be murdered, and a new directory and legislature appointed from among the most violent of their own party; but the plot was discovered, and the principal agents in it arrested. On the 9th of June, this year, the Dauphin died in the temple, and his sister was soon afterwards delivered up to the Emperor of Germany, in exchange for the commissioners, whom Dumourier had sent prisoners to the Austrians, and for two Frenchmen, who had been seized on their way to Turkey.

Death of the Dauphin.

As the campaign of 1795 had terminated unsuccessfully to the French on the Rhine, the Directory resolved to exert their utmost endeavours to open that of 1796, in such a manner as would restore their superiority, and regain their conquests. But when they began to examine the means that they possessed for recruiting the armies, and supplying them with the necessary provisions and stores, they found a lamentable deficiency of money. The assignats were excessively depreciated; nor could their credit be any longer supported by the most severe decrees, while an increased issue only augmented the depreciation. It was therefore resolved, on the 25th of March 1796, to dispose of the remainder of the church lands; but it seems not to have entered into the thoughts of the Directory, that, as the purchase of them would be paid for in paper money, the actual proceeds would amount to very little. As soon as they found this to be the case, the legislature decreed that one-fourth of every purchase should be paid in cash; and this almost immediately put an entire stop to the sale of the property, and consequently to this source of revenue.

Campaign of 1796.

Notwithstanding this disappointment, the French prepared to open the campaign with an immense force. The army of the Sambre and Meuse, under the command of Jourdan, was stationed at Dusseldorf and Coblentz; Moreau had the command of the army of the Rhine and Moselle, on the upper Rhine; and Bonaparte, who had been brought into notice during the disputes between the Convention and the Parisians, in the preceding year, had the command of the third army on the Italian coast, from Nice to Genoa. The wonderful advantages of Bonaparte in Italy, and the defeat of Jourdan, and retreat of Moreau, in Germany, render this campaign extremely interesting and important.

onaparte com- and.

As soon as Bonaparte assumed the command, he threatened Genoa. This induced Beaulieu, who commanded the Austrian troops, to resolve on the attack of the whole French line; but the attack being unsuccessful, and part of his army out-flanked by the French, he was compelled to retreat. Bonaparte immediately followed up his advantage. On the 14th of April, having broken in between the Piedmontese and the Austrians, he defeated the former; and, by his subsequent success over them, compelled the King of Sardinia to purchase peace, by the surrender of Savoy, Nice, &c. The Austrian general, being deserted by his ally, was now obliged to act on the defensive, and, for this purpose, took up a strong position behind the Po. But Bonaparte, instead of crossing that river at Valentia, which Beaulieu expected he would do, marched into the dominions of the Duke of Parma, and passed it at Placentia. The Austrian general being thus forced to abandon the Po, retreated to the neighbourhood of Lodi, in the Milanese.

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The bridge, at this place, over the Adda, was defended by 30 pieces of cannon, which rendered its passage so very formidable, that all the officers whom Bonaparte consulted, were of opinion it could not be forced; but the grenadiers expressing their willingness to undertake the enterprise, were formed into a close column, and reached the middle of the bridge unperceived, in consequence of the smoke of the cannon. Here they were mowed down in great numbers, and began to hesitate; but they were animated to press on by their officers, and succeeded in gaining possession of the bridge. The retreat of the Austrians having been protected by a body of Neapolitan cavalry, their loss was not so great as that of the French. The conquest of the Milanese, and of Ferrara, Bologna, and Urbino, were the fruits of this victory, the Austrians retiring into the bishopric of Trent.

Its consequences.

Naples and Tuscany fought and obtained peace. The siege of Mantua was the next object of the conquerors; but they were drawn from it by the re-advance of the Austrians under General Wurmser, who had been appointed to supersede Beaulieu. This general was not more successful than his predecessor; and being obliged, after repeated defeats, to retire to the Tyrolese frontier, Mantua was re-invested. After a month's respite, the armies again tried their strength, and the Austrians being again defeated, the victors took possession of Trent. They did not, however, at this time, long keep possession of this district, for Wurmser; by his manœuvres, drew them out of it; and though he sustained another defeat, yet, in his retreat, he succeeded in encouraging the garrison of Mantua, by throwing himself into that place. The Austrian army was now placed under the command of Alvingi, who, at first, was partially successful, but was at length driven across the Brenta by Bonaparte. Mantua, however, still held out at the end of the year 1796.

Operations in Germany.

The armistice in Germany terminated on the 31st of May. In consequence of the success of the French at the commencement of this campaign, the Archduke Charles left the Palatinate, to force Jourdan down the Rhine. In this he succeeded; but in the mean time, Moreau had crossed that river at Kehl, against him therefore the Archduke thought it proper to advance; and Jourdan, taking advantage of this, again crossed the Rhine, and afterwards the Lahn, and gained possession of Frankfort. The Archduke, apprehensive that Jourdan and Moreau would form a junction, resolved to attack the latter before it took place; but Moreau anticipated him, and the Austrians were compelled to retreat. Their army also, which was opposed to Jourdan, retreated, keeping up, however, a communication with the main army under the Archduke. The line of their retreat was through Swabia; and, by the end of August, the three republican armies, under Moreau, Bonaparte, and Jourdan, were possessed of the whole country from the frontiers of Bohemia to the Adriatic, with the exception of a part of the Tyrolese. The German princes took the alarm, and many of them made peace with France. Had Bonaparte, at this period, been able to have crossed the Tyrolese, and reached the Danube, the Emperor must also have submitted to whatever conditions the French chose to dictate.

The Archduke Charles being strongly reinforced, endeavoured to oppose the advance of Moreau; but not succeeding, he crossed the Danube, and attacked Jourdan, leaving part of his army as a check on Moreau. Jourdan was now under the necessity of retreating, till, by the middle of September, he arrived at Coblentz and Dusseldorf, from which places he had advanced at the beginning of the campaign.

Celebrated retreat of Moreau.

Moreau, in the mean time, endeavoured to drive before him the part of the Austrians which were left to watch him; but they, having been reinforced, he could not penetrate beyond the Iser. His communication with Jourdan was now completely cut off, and for some weeks he was ignorant of his fortune or movements. As soon, however, as he learned that he had been compelled to retreat, he was sensible that it was absolutely necessary for him to retreat also. In order to deceive the general who was opposed to him, he at first moved as if he meant to penetrate further into Austria; and having thus compelled his adversary to fall back, he began his retreat between the Danube at Ulm, and the

Lake of Constance. On his rear the Austrian general hung incessantly: his route through the Black Forest was occupied by numerous bodies of Austrians and armed peasantry, while his right flank was harassed by another army of 24,000 men. Notwithstanding the extreme difficulties of this critical situation, he continued his retreat in the most excellent order, and actually more than once turned upon and defeated the army that was pursuing him. The dreadful passage of the valley of Hell, overhung with lofty mountains, and in some places only a few fathoms broad, was forced by the centre of his army in a mass, while the wings opposed the Austrian armies that hung on his rear and flanks. On the 15th of October he arrived at Friburg; but he was soon afterwards forced by the Archduke to abandon all his positions on that side of the Rhine, except Kehl. This place also the Archduke was resolved to reduce; but not being able to succeed, and the French, finding their whole frontier exposed, the latter evacuated it in the beginning of 1797.

Campaign of 1797.

The first object of the Austrians in 1797, was the relief of Mantua. General Alvingi's army was upwards of 50,000 strong. At first they were so successful against a division of Bonaparte's army, that their immediate capture was expected. As soon as that general was informed of their critical situation, he hastened to their relief. On the 14th of January, a most obstinate battle took place at Rivoli. The centre of the French was on the point of giving way, both their flanks were surrounded, and the defeat of Bonaparte seemed certain, when, by a masterly manœuvre, he completely changed the fortune of the day, penetrated the right wing of the Austrians at various points, and threw them into such disorder, that 4000 of them threw down their arms. On the following day, 6000 more were surrounded and taken prisoners. Bonaparte now hastened to meet that part of the Austrian army which was threatening the lines of the blockade, and succeeded in capturing the whole of them. The defence of Mantua being now hopeless, General Wurmser capitulated.

Battle of Rivoli.

The humiliation of the Pope was the next object of Bonaparte. The forces of his Holiness were soon subdued, and he was compelled to sign a peace, dictated by the French general.

The French government having failed in their attempt to reduce the Emperor to submission by the campaign on the western side of Germany, resolved to penetrate into his hereditary dominions on the side of Italy. They, therefore, sent strong reinforcements to Bonaparte. On the other hand, the Archduke Charles took the command on the southern frontiers of Austria; but, instead of waiting for the enemy in the mountains, he was directed by the council of war at Vienna to descend into the plains, and defend the rivers. The consequences of this absurd plan were fatal to the Austrians, who were driven from all their positions, and lost their principal magazines. In fifteen days Bonaparte took 20,000 prisoners, and effected the passage of the Alps. His way to Vienna was now open; but not insensible of the danger to which even his successful progress had exposed him, he wrote to the Archduke on the 31st of March, proposing peace. The latter replied, that he had no authority to treat; and, in the mean time, the inhabitants of the Tyrol rose *en masse*. Neither they, however, nor the regular Austrian armies, were able to stop the progress of the French, who, on the 2d of April, forced the strong defiles between Friesach and Newark. This success, and another defeat which the Austrians sustained on the 4th, induced the Emperor to treat for peace; and on the 19th a preliminary treaty was signed, by which the French were to retain the Austrian Netherlands; and the Milanese, Mantua, Modena, and Bologna, were to be formed into one state, and to be called the Cisalpine Republic. This was followed by a definitive treaty at Campo Formio, which confirmed these articles, and gave the French the Venetian islands in the Levant. While these operations were going on in the south of Germany, Generals Hoche and Moreau not only prevented the Austrians on the Rhine from sending reinforcements against Bonaparte, but even gained several advantages over them, and pursued part of them towards the Danube.

Treaty of Campo Formio.

In the midst of these wonderful successes, there were still divisions and disputes among the members of government at Paris. A decided majority of both councils, as well as two members of the Directory, were of the Moderate party; but, in consequence of some violent discussions respecting finance, and the restoration of the property of the emigrants, the legislative and executive branches became professed enemies to each other. General Hoche, with a division of the army, was brought into the neighbourhood of Paris by the Directory; and Augereau was sent for from Italy by the opposite party. The latter surrounded the Thuilleries, and made Pichegru and twelve more chiefs of the opposite faction prisoners; Carnot escaped, but Barthelemy was put under arrest. Shortly afterwards the councils, in a most arbitrary and tyrannical manner, voted the transportation to Cayenne of 53 of their own members, and 12 other persons, among whom were Barthelemy and Pichegru. In the room of the displaced directors, the legislature chose Merlin and Francis de Neufchateau. About this time the negociation with England, conducted by Lord Malmsbury, failed.

State of Paris.

France was now at peace with all the powers of Europe except Great Britain. The transactions that took place between them are recorded elsewhere; we shall therefore confine ourselves to an account of the conduct of the French towards the Pope, Switzerland, and Naples, during the year 1798. At Rome, some disturbances happened between the French party and that portion of the inhabitants who remained faithful to his Holiness. In the course of these disturbances a French general was shot, and Joseph Bonaparte, who was there as plenipotentiary, demanded his passports, and returned to Paris. The Pope, alarmed, solicited the protection of Vienna, Spain, Naples, and Tuscany, but they would not interfere. General Berthier with an army marched against Rome, subverted the dominion of the Pope, and proclaimed the sovereignty of the Roman people. Ever since the first successes of Bonaparte in Italy, the French had instructed their generals to demand, or take by force, all the most valuable paintings, antiquities, &c.; but on the capture of Rome, these, instead of being sent to Paris, as the spoil of other cities had been, were sold on the spot.

Conduct of the French in Italy, A.D. 179

In Switzerland, French principles had been successfully propagated; and early in 1798, the Directory resolved to take advantage of this circumstance, and reduce this country. A pretence similar to that which they had eagerly embraced at Rome occurred; and was as eagerly embraced: the Pays de Vaud was invaded, and by the end of January reduced. The senate of Berne now prepared for an unequal contest; but they soon found, that not only a large portion of the inhabi-

In Switzerland.

tants of this canton, but also of the army, were disaffected. Notwithstanding this, they imprudently decreed the rising of the people in a mass: the people did rise, but they dissolved the government. They were, however, by no means willing, that the French should interfere in their disputes, and therefore offered terms to them, which were rejected. The enemy continued to advance; the Swiss in vain opposed them, and injured their own cause by murdering their officers, after a complete defeat that they suffered early in March. Berne capitulated, and most of the other cantons followed its example. A new constitution was framed at Paris for this country; but the inhabitants of the smaller and more democratic cantons refused to accept it, and took up arms. At their head was Aloys Reding, a man of superior purity of patriotism and talents; but all his efforts were unavailing, the confederacy being soon dissolved by the arts and the overwhelming power of the French. Scarcely, however, had an accommodation taken place, when new commotions arose, which partook of the madness of despair; even the women rushed into the midst of the battle; and the robust mountaineers actually pressed Frenchmen to death in their arms. The French retaliated, by the infliction of every species of cruelty that they could devise; and, after a short but desperate contest, overthrew the independence of Switzerland.

In Naples.

The King of Naples having imprudently placed so much confidence in the consequences of the victory of the Nile, as to declare war against the French, and to advance to the re-conquest of Rome, the Directory resolved to crush him. This was an easy task; the Neapolitan troops were few in numbers, and excessively ill disciplined; they fled before, or weakly opposed, a comparatively small number of French. Rome was recovered; Gaeta surrendered. General Mack, who commanded the Neapolitan troops, being driven from Capua, and not being able to depend on his army, surrendered himself, and the officers of his staff, to the republican general. A short time before this, the King of Naples, having embarked for Sicily, the loyal populace of that city, and the peasantry of the adjoining district, attacked the enemy, but being defeated, the metropolis submitted to the French yoke.

Towards the end of 1798, there were signs of the renewal of the confederacy against France. The Russians had already commenced hostilities in the Levant, soon after they heard of the victory of the Nile; and being subsidized by Britain, they marched an army of 45,000 men to the confines of Germany. Austria, however, was at first afraid to engage in a new contest; but not giving a satisfactory answer to the French, who declared, that the entrance of the Russian troops into Germany would be considered as a declaration of war, the Directory, on the 13th of March 1799, ordered the commencement of hostilities, not only against the Emperor, but also against the Grand Duke of Tuscany. At the commencement of this war, the prospects of the French were very flattering, and they possessed many advantages which they had not during the previous contest. They were very powerful on the Rhine, by the occupation of Dusseldorf and Mentz. They also had the command of Switzerland, and all the strong places in the north of Italy. Their first object was to obtain possession of the Grison country, that a communication might be preserved with Germany. Massena advanced for this purpose; while Jourdan, who commanded on the upper Rhine, advanced on his side, in order to meet him. Massena soon reduced the Grisons; but he was defeated in his next enterprize, the reduction of the post of Feldrich, which was held by the Austrian General Hotze. The Austrians, however, could reap little advantage from this success, but deemed it prudent to retreat into the Tyrol. The Archduke was opposed to Jourdan, and he was more successful; the French general being obliged to retreat with considerable loss. Jourdan was soon afterwards removed, and Massena appointed to command his army.

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Operations in Italy between the French and Austrians.

But the most important scene of operations this year was Italy, where the Austrians were successful in several engagements, even before the junction of the Russians. This event took place about the beginning of April, and Suwarrow, who assumed the command of the combined army, resolved to pursue a bold plan of operations. Moreau was opposed to him, but the Russian general deceived his adversary, drove him from his entrenchments on the Adda, and obliged him to retreat to Pavia, after having suffered a dreadful loss. Moreau shortly afterwards gained some successes over a detached part of the Russian army, but Suwarrow advancing, he was obliged to continue his retreat. At this crisis, Macdonald, who commanded the French army in the south of Italy, pushed forward for the purpose of joining Moreau. But he found that it would be previously necessary to attack the allies; and Moreau endeavoured, by circulating a report that he was about to receive reinforcements, to withdraw the attention of Suwarrow from Macdonald. The latter began his operations on the 12th of June; and succeeded so far as to enter into Parma on the 14th; but his progress was arrested on the 17th. As soon as Suwarrow was informed of his advance, he left Turin at the head of 20,000, and came up with him on the banks of the Tedone: for three days, there was a succession of desperate battles; and the victory was at last obtained by the Russians, in consequence of General Kray, who commanded the army besieging Mantua, arriving, in direct opposition to his orders, with large reinforcements. Suwarrow was indefatigable in his pursuit of the beaten army, and having surrounded their rear guard, it was obliged to surrender: the remainder took refuge in the Apennines and in the Genoese territory. Moreau, in the mean time, was victorious over the Austrian General Bellegarde; but his victory availed little, in consequence of the success of Suwarrow, and the Italian fortresses fell into the hands of the allies. Soon afterwards, in consequence of a political change in Paris, Joubert was ordered to supersede Moreau, who, however, continued in the army as a volunteer. It was the plan of Joubert to bring Suwarrow to battle as speedily as possible; and being reinforced by the remains of Macdonald's army, he succeeded in his plan at Novi, on the 15th of August. Scarcely had the engagement commenced, when Joubert was killed, and Moreau resumed the command: the victory was doubtful, till it was decided by the right flank of the French being turned. This division immediately fled, and the rest of the army joined in the retreat, which they continued till they took up a strong position in the Genoese territory. The surrender of Tortona was almost the only result of this victory.

In Switzerland.

The Directory, thus unsuccessful in Italy, resolved to make Switzerland the grand scene of operations, and to adopt a new plan. In the month of August, Massena had the command here of 70,000 men; and being superior to the Archduke, whose position he threatened, Suwarrow marched to his relief. But the cabinet of Austria, jealous of the success of the Russian general, ordered the Archduke to go into Suabia with upwards of 50,000 men, and Switzerland was thus left exposed. Of this Massena resolved to take advantage, by attacking the remainder of the Austrian army before Suwarrow joined them. The French were successful, though the combat was long and obstinate. Massena next advanced to meet Suwarrow; and surrounded him in such a manner, that it was thought impossible he should escape; but that general having discovered one pass in the mountains unoccupied by the French, he made his way through it, with the loss of his cannon and baggage. Disgusted and indignant at the want of support from the Austrians, he withdrew his forces to the neighbourhood of Augsburg, and transmitted his complaints to Petersburg. In the mean time, the Directory had sunk into contempt; and by their disputes among themselves, as well as the imbecility of their conduct, promised an easy overthrow to any daring adventurer. Such a man was Bonaparte, who at this time returned from his expedition to EGYPT; an account of which is given in the Histories of that country and of BRITAIN. Bonaparte had several friends in the councils and Directory, the most active of whom were Sieyes and Talleyrand. After several discussions, they resolved that a consulate should be formed, and Bonaparte placed at its head. This scheme was concealed from Moreau, Berthier, and the other generals who were then in Paris. The majority of the assembly of Elders agreed to the proposal; but as the Jacobins preponderated in the Council of Five Hundred, they resisted it. Bonaparte, however, rushed into their hall, while they were deliberating, on the 10th of November 1799, with a military force, and expelled the members. Three chief magistrates were appointed, with the appellation of Consuls; of whom Bonaparte was at the head, and Cambaceres and Lebrun the other two. The senate was to be composed of 80 individuals; 100 were to form a tribunate, and 300 a legislative body. In order to render this violent change of the constitution less obnoxious, it was decreed that the First Consul should hold his office only for ten years, and the other two for five years. This change was defended, on the ground that it was necessary to give to the government a greater degree of consistency and stability than it had hitherto possessed.

Return of Bonaparte from Egypt.

A. D. 1799.

Declared first consul.

One of the first measures of Bonaparte, after he had gained the supreme power, was to propose peace to Britain; but his proposal being rejected, he began vigorous and extensive preparations for hostilities in Italy, and on the Rhine; while an army of reserve, amounting to 60,000 men, was ordered to be assembled at Dijon, under his immediate command.

State of Italy, A. D. 1800.

In Italy, at the beginning of 1800, the French retained scarcely any of their conquests, except the republic of Genoa, and this the Austrians were preparing to wrest from them. In the city of Genoa, Massena took the command, and resolved to defend it to the last extremity. In the beginning of April, the Austrian general Melas, and a British fleet, invested it so completely, that the communication with France was cut off. General Melas having thus prevented the possibility of its relief, left some troops before it, and marched with the main body against the French general Suchet, whom, on the 7th of May, he totally defeated. In consequence of this defeat, they crossed the Var, and entered France, and the Austrian general became master of the whole department of the maritime Alps.

On the Rhine, General Moreau was opposed to General Kray; but the latter was fettered by the orders which he received from the council of war at Vienna, whereas Moreau refused to act according to the instructions sent him by the Chief Consul, except where his own judgment and observation convinced him they were wise and practicable. The plan of Moreau was to cross the Rhine; in this he succeeded, and drove Kray before him as far as Ulm: here he fortified himself; but Moreau, manœuvring in such a manner, as to threaten to cut him off from his magazines, the Austrians were obliged to fight at Hochstet. The French were victorious, and the Austrian general, after in vain endeavouring to oppose the enemy again at Newburg, was obliged to fall back to Ingolstadt. The electorate of Bavaria was conquered: the hereditary dominions of Austria were threatened, and at Vienna the populace demanded peace.

Of Germany.

The affairs of Austria were not more promising on the side of Italy. The army of reserve that had been collected at Dijon, marched, as soon as the campaign opened on the Rhine, towards Italy. The First Consul joined them near the Lake of Geneva; and the passage of the Alps was immediately prepared to be undertaken. The difficulties only served to stimulate the ambition, the energy, and the talents of Bonaparte. The trunks of trees were hollowed into the forms of troughs, that the cannon might slide along in them; the gun-carriages were conveyed on sledges, and the wheels on poles. Their passage was over Mount St Bernard, which the men could only ascend one by one, moving with the utmost caution. The descent was still more dangerous; but so admirably were the measures of Bonaparte planned and executed, that scarcely any lives were lost; and none of the cannon or provisions were left behind. Thus was effected the passage of a numerous and well-appointed army over the Alps,—an enterprise so extraordinary, that the Austrians, from a firm conviction that it was absolutely impracticable, never thought of opposing it. Aosta, the fort of Bard, Ivria, Romagno, and Vercelli, were taken. The Tessino was crossed; Milan entered without opposition; valuable magazines were captured at Pavia; and Placentia fell into the possession of Bonaparte, who, by his sudden and unexpected appearance, and by his subsequent masterly manœuvres, completely out-generaled Melas.

Bonaparte's passage of the Alps.

He did not arrive, however, in time to relieve Genoa; for Massena, after one of the most obstinate defences recorded in history, during which 15,000 of the inhabitants are said to have perished by disease and famine, was compelled to surrender to the Austrian and British commanders on the 5th of June. As soon as Genoa fell, Melas dispatched General Ott with 30 battalions to check the progress of the French, who hitherto had not penetrated farther than Piedmont; but that general having suffered a dreadful defeat at Mon Abello, Melas collected his whole force between Allessandria and Tortona. Here, on the 14th of June, was fought the battle of Marengo: for nine hours the Austrians were victorious; but an imprudent or unskilful movement of General Melas, which was instantly taken advantage of by General Dessaix, who made a vigorous charge with a body of fresh cavalry, turned the fate of the day. The victory was purchased by the death of Dessaix, to whose memory due honours were paid by his grateful countrymen.

Fall of Genoa.

Battle of Marengo.

The Austrian general, intimidated by his defeat, requested a truce, which was granted on condition that Genoa should be surrendered, as well as the principal fortresses in Piedmont and the Milanese. General Kray was desirous of extending this armistice to Germany, but to this Moreau would not consent; and two battles were fought without much advantage on either side. The French, however, persevered in their attacks, and at length opened themselves a passage into the heart of Bavaria. At this period, Count St Julien arrived with proposals of peace from the cabinet of Vienna, and the armistice was extended to Germany. This armistice did not lead to peace, for the Emperor, encouraged by Britain, resolved to try the chances of another campaign: hostilities therefore recommenced in the autumn. At first Moreau was surprised by the activity, and nearly defeated by the impetuosity of the Austrians; but the Austrian general abandoning his strong position, the fatal battle of Hohenlinden was fought on the 3d of December. In this battle, the Austrian centre was pierced, and their wings thrown into confusion; their loss was dreadful; their route complete. Pushing into Upper Austria, the victorious French reached the banks of the Ems. The cabinet of Vienna was alarmed; the Archduke, who had been deprived of the command of the army, was recalled; but all his skill and efforts were in vain; and the Emperor mournfully saw that peace alone could save him from utter destruction. The treaty of Luneville was the consequence.

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Soon after Mr Addington became prime minister of Britain, a negociation was opened with France, which terminated in the peace of Amiens, on the 22d of *March* 1802.

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At this period, the territories of the French republic were very extensive, and her power extended even beyond these territories. With France, as it existed previously to the Revolution, was incorporated the Netherlands, and that part of Germany which lies on the west of the Rhine, as well as Geneva, the duchy of Savoy, and the principality of Piedmont. The Dutch republic was completely subservient to the will of France; the Swiss possessed scarcely a larger portion of national independence. Spain, under the appellation of an ally, was in fact a vassal state. The Cisalpine republic was completely under the yoke of the First Consul, who had been appointed its President for ten years. This republic not only comprehended the Milanese, but also a considerable part of the Venetian territories, the duchies of Mantua, Modena, and Parma, and some of the districts which had belonged to Rome. A vassal king governed Tuscany, which was thus in reality placed under the power of France; and the Ligurian republic was equally subservient. Over all this immense tract of country, therefore, extending from the Ems to the Straits of Gibraltar, and from the Atlantic to the Adriatic, did Bonaparte, as First Consul of France, exercise an absolute sway.

But his power in fact was not limited, even when this immense territory was included within it. The Emperor of Germany and the German Princes had suffered so much from French invasion, that they durst not question the authority of Bonaparte; the King of Prussia had very recently displayed his devotion to his wishes, as well as an unjust regard to his own interest, by the seizure of Hanover; and the new Emperor of Russia was too recently and mysteriously fixed on the throne, to come forward against the power of France.

Britain alone, therefore, which had so long, and with such wonderful perseverance and sacrifices, resisted France, came out of the contest untouched in her national independence.

One of the first measures of Bonaparte, after he had placed France at peace with all her enemies, was the re-establishment of the Catholic religion. For this purpose, a concordat or convention was concluded between him and the Pope, of which the following are the most important articles. No bull, &c. of the court of Rome, to be circulated or put in force without the authority of government: No nuncio, legate, &c. to exercise his functions in France, without the consent of the government: No person to be named a bishop who is not a Frenchman: No bishop to quit his diocese, without leave from the First Consul: No festival, with the exception of the Sabbath, shall be established without the permission of government. The nuptial benediction shall be given to those only, who shall prove in due form that their marriage has been contracted before a civil magistrate. All religions were tolerated and protected, and special rules were laid down for their guidance.

Bonaparte
appointed
consul for
life.

By this concordat, Bonaparte gained great popularity with the mass of the nation; and as he was almost idolized by the soldiers, he experienced no difficulty in increasing his power. When he was chosen First Consul, ten years were to be the duration of his authority; he was now, however, appointed for life, and the power conferred upon him of nominating his successor. Shortly after this, his plans for another war began to develope themselves. On the 21st of February 1803, a view of the state of France was laid before the Legislative Body and the Tribunate, the most interesting and important part of which related to the dispute with Britain, regarding the retention of Malta. The nature and result of this dispute, we shall not here enter into, as they, as well as the subsequent war, are fully narrated in the History of BRITAIN. As soon as Bonaparte resolved on hostilities with Britain, he marched an army into Osnaburgh and Hanover, and gained possession of these districts without opposition. On the 25th of April 1804, he was declared Emperor, by a decree of the Tribunate of France, to the following purpose.

Declared
Emperor,
25th April
1804.

When the national will (it was said) could manifest itself freely, it declared for the unity of the supreme power, and the hereditary succession of that power. This desire had been for a time extinguished by the tyranny of the family of the Bourbons, and the nation were driven to adopt a democratical form of government; from this form, however, only the miseries of anarchy proceeded; and the state was in the most extreme danger, when "Bonaparte, brought back by Providence, suddenly appeared for its salvation:" That the consulship for life, and the power granted to the First Consul of appointing his successor, could not prevent internal intrigues; in order, therefore, to avoid them, and at the same time to follow the example of all great states, ancient and modern, and to comply with the first wish of the nation expressed in 1789, the magistracy ought to be declared hereditary. This declaration the nation now makes more strongly and generally than ever; and her gratitude and affection point out Bonaparte, *from whom and his family France expects more than any other, the maintenance of the rights and liberties of the people:* That there is no title more suitable to his glory, and to the dignity of the supreme chief of the French nation, than that of Emperor.

Such was the decree of the tribunate, which was followed by voting, "That Napoleon Bonaparte, the First Consul, be proclaimed Emperor of the French, and in that capacity be invested with the government of the French Republic:" "That the title of Emperor, and the imperial power, be made hereditary in his family in the male line, according to the order of primogeniture."

This vote was carried by acclamation, Carnot being the only person who spoke against its adoption. The Senate and the army followed the example of the Tribunate, intreating Bonaparte to become Emperor of France. Thus easily and tranquilly did Bonaparte obtain the object of his desires.

As he had been long married without children, he was allowed to adopt the children or grandchildren of his brothers, when they arrived at the age of eighteen, provided he had no legitimate children. On the failure of both legitimate and adopted heirs, the crown was to be enjoyed by his eldest brother Joseph, and his descendants; and, failing them, by his next brother, and his descendants, &c. The members of the imperial family were to be called French Princes, and the eldest son the Imperial Prince. Every Emperor, within two years after he came to the throne, was to swear to maintain the integrity of the French empire.

Thus that revolution, which was begun for the express purpose of establishing a free government,—which, shortly after its commencement, destroyed the king and the monarchy, and during which the very suspicion of being attached to the royal cause exposed the suspected party to certain death, terminated in the establishment of a military despotism.

We have hitherto deferred entering into a developement and explanation of the causes which produced, either directly or indirectly, or generally or partially, this revolution, as well as of the causes to which we ought to ascribe the rapid and total change in the nation, from an apparently strong and sincere attachment to liberty, to at least an acquiescence in military despotism; and of those causes which contributed to the astonishing, and almost unparalleled successes and victories of the French arms. All these we have hitherto deferred entering upon, in order that we might view them in connection with each other; for, in our opinion, these three events are intimately and necessarily connected, springing out of each other, as well as all of them, in some measure, originating from the same circumstances. We shall now consider them in their order.

Causes of the Revolution.

I. With respect to the causes which produced the French revolution, either directly or indirectly, either partially or generally, in France, it may be proper to premise some general remarks on the causes which alter the character or fate of nations. Before philosophy had lent her aid to the lessons of experience and observation, so as to draw from them their legitimate consequences, it was supposed that the fate of a nation depended on the character and conduct of the leading individual or individuals in it; and when that character and conduct were pointed out and explained, it was taken for granted, that the particular circumstances in the national history, which had attracted attention from their extraordinary nature, were also sufficiently accounted for. But philosophy taught, that no individual can operate changes, or produce effects of an extraordinary nature, in any country, unless he act on materials suited to his purpose; and that, as he must have been formed by the prevailing spirit and habits of the nation on which he is supposed to operate, the very existence of such a character as his, is a proof that the nation was tending towards that change, which was solely attributed to the influence of his character and efforts. We must, however, guard against going into the extreme of this opinion; for there can be no doubt, that though favourable circumstances must pre-exist, before any individual can radically affect the character, or produce any great change in the fate, of a nation, yet, on the other hand, some thing ought to be ascribed to the influence of individual character. Perhaps a more striking proof of this cannot be exhibited, than what the history of Prussia affords us: During the reign of Frederic the Great, this kingdom stood high in the rank of nations in a military point of view. That the Prussians possessed the requisites for making good soldiers, is admitted; but it may surely be questioned, whether, if Frederic the Great had not been the character he was, Prussia would have gained the pre-eminence she did in warfare, or the advantages resulting from that pre-eminence. That this opinion is correct, the history of Prussia, after the death of this king, sufficiently proves: another sovereign, of a different character, or, more properly speaking, of different talents and habits, ascended the throne, and Prussia immediately sunk in the scale of nations. Perhaps the legitimate conclusion to be drawn, is, that in nations highly civilized and enlightened, in which almost every individual has an independent political existence, and regards himself as a component part of the government, individuals can do little or nothing except through the instrumentality of the nation, by conforming to its character, and employing its prejudices and feelings in the schemes which they are desirous to carry into execution; whereas in a nation rude, ignorant, and barbarous, in which the great mass of the nation have no conception that they have any right to interfere in the conduct of their governors, events are much more, though still not by any means entirely, under the influence and direction of individual character.

Let us now consider the revolution of France with reference to these observations, and the causes which have been supposed to have produced that event.

In the first place, much has been ascribed to the influence which the writings of such men as Montesquieu, Voltaire, Rousseau, Helvetius, &c. produced on the opinions and wishes of the French people; but it should be recollected, that on the mass of the people these writings could have little or no influence, as by few of them they were read, nor could they have been understood had they been read. The hypothesis that ascribes the French revolution to this cause, confounds two distinct circumstances; or rather supposes, that when it has accounted for one part of the phenomenon, it has accounted for the whole. The events of the revolution sufficiently prove, that, even at its commencement, it was indicated not more by a change in the character, opinions, and conduct, of the more intelligent classes of the French community, than by a change in the characters, opinions, and conduct, of the great mass of the people, on whom the writings of the philosophers could have had no influence. While, therefore, we may regard these writings as having prepared the way, in some degree, for the revolution among the higher and more intelligent classes, we ought not to consider them as being exclusively the cause, even with regard to them, and certainly as by no means the cause with regard to the mass of the people.

Nearly the same remarks will apply to the second cause to which the French revolution has been attributed. It has been said, that, by the return of the officers and soldiers who served in America, principles and feelings of liberty were spread over France, which, meeting with favourable circumstances, developed themselves, and by their operation ultimately overthrew the government. But, in the first place, it may well be doubted whether any great number of the officers and soldiers who had served in America imbibed principles and feelings of liberty there. The military certainly (especially in France at that period) seldom pay much regard to the nature of the cause for which they fight, or feel much sympathy for liberty. Some, no doubt, went to America from the laudable desire of assisting in establishing the independence of that country: and many who went from other motives, may have returned with a change in their sentiments favourable to liberty; but there can be no doubt that by far the greater proportion went to America because they were ordered by their government; fought there, as they would have fought in any other country; and returned from this war as they would have returned from any other war. In the second place, even allowing that the returned officers and soldiers very generally imbibed the spirit of liberty, yet it by no means follows that they had it in their power to infuse this spirit into any large portion of their countrymen. Indeed, the remarks of travellers confirm this; for while, even before the American war, and much more so after it, they observe, that very free notions respecting government and religion were prevalent among the higher classes of the French nation, they do not mention that such notions were entertained by the mass of the people; and we should recollect, that in France, at this time, there was no middle class in the country at large.

Despotism of the government.

The next cause which we shall consider, attributes the Revolution to the despotism of the government. That the government of France was in its nature despotic, cannot be denied; but it is equally certain, that at the period of the Revolution, this despotic government was exercised with more regard to the freedom and the happiness of the subject, than it had ever been at any previous period. To this cause, therefore, the Revolution cannot be ascribed.

From the preceding observations, it will be sufficiently apparent, that in tracing and explaining the causes of the Revolution, we must discriminate, and consider apart several circumstances that have too often been confounded, namely, the causes which operated to produce the Revolution, as they existed in the higher and more enlightened classes of the community; those which existed and operated in the great mass of the people; and the circumstances in which the nation was placed, which allowed or encouraged these distinct causes to operate together with the fullest effect.

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In the first place, the causes which operated to produce the Revolution as they existed in the higher and more enlightened classes of the community, may be divided into two kinds; those which originated from principles and feelings of liberty, and those which originated solely from a desire to throw off particular grievances. We have already admitted, that the writings of the French philosophers had disseminated among these classes, very free notions on the subjects of government and religion; and that the return of the army from America may have tended still farther to confirm and propagate liberal ideas on government. But there were many descriptions of men in France, who, in addition to, or independently of, their attachment to the cause of liberty, were anxious to free themselves from particular grievances. The nobility were anxious to regain those privileges of which they had been stript by the crown. The provincial noblesse beheld with contempt and indignation the follies, the profligacy, and the power of the higher nobility. The inferior clergy regarded their superiors with the same feelings; but, more especially, "the practising lawyers, almost entirely excluded from the chance of becoming judges, wished eagerly for a change of affairs, not doubting that their talents and professional skill would render them necessary amidst any alterations that might occur." In short, there was a mutual repulsion among the leading classes of the community, arising from a change in their feelings and wishes, without this change being accompanied by a corresponding change in their situation, or in the conduct of government towards them.

It ought also to be stated, that besides those who wished, or were prepared for a Revolution, expecting from it, either the realization of their schemes and hopes respecting liberty, or the removal of their particular grievances, there were, in Paris particularly, an immense number of desperate and unprincipled persons, who eagerly looked forward to a convulsion which they had no doubt would be the accompaniment of a Revolution, and from which they anticipated the full indulgence of their most violent and depraved passions.

Among the mass of the people.

The causes which revolutionized the great mass of the people, are quite distinct from those we have just enumerated. When, indeed, the first symptoms of the Revolution became manifest, many thought it would not spread over the nation, when they reflected how ignorant the people were, how blindly and obstinately attached to old establishments, how passionately devoted to their monarch, and every thing that concerned him; and that, though oppressed by the nobility, and neglected by the government, they seemed quite insensible to the miseries of their condition, and exhibited more striking symptoms of content and happiness than nations much freer and more highly favoured. How then were such a people changed, and changed so completely, as to hear of the execution of their monarch with exultation? The cause when explained is very simple. The peasantry, though accustomed, were not utterly insensible to the tyranny of the nobles; nor could they behold with indifference, scenes of profligate and wanton extravagance displayed at their chateaus, at the very time when their own cottages were the abode of misery and famine. Though utterly ignorant of the meaning of political liberty, they knew what was meant by being freed from the oppressions, taxes, and vexations to which they were subject, and still more keenly did they enter into the prospect of having it in their power to retaliate on the nobility the evils they had suffered from them. In short, at the commencement of the Revolution, they received, or seized on power; and very naturally became attached to that event, from which such a blessing in their estimation proceeded. Had the Revolution only promised them political liberty, they would have regarded it with indifference; with them it would have found no supporters; but addressing itself to their passions and feelings, they rose in favour of it, and in their exultation, at their liberation from the oppressions under which they had long groaned, and at the ruin of those who had regarded their misery with indifference, or perhaps essentially contributed towards it, they forgot their loyalty, and beheld in their monarch only the chief of their oppressors.

We are now to consider the circumstances in which the nation was placed, which allowed or encouraged those distinct causes to operate together with the fullest effect.

Embarrassed state of the finances.

We have already noticed the embarrassed state of the French finances at the termination of the American war in 1783; and that the government, finding all their plans ineffectual towards the bringing them into order, were at last compelled to assemble the Notables. Thus were collected at Paris most of those men who were desirous of a change; and who beheld themselves in a condition, from the wants of the government, the appeal which had been made to them to suggest measures for the supply of those wants, and their own strength, to use their efforts for the accomplishment of their wishes. Their objects, indeed, might differ; for while some wished merely to curtail the power of the crown, in order to restore the privileges of the nobility; others wished to attack the power and privileges both of the crown and the nobility. Under these circumstances, it is evident, that the former was placed in a situation of great peril, and that the objects of the nobility were not so likely to be attained as those of the other party, since they had to concert their measures in such a manner as at the same time to act against the crown, and against that party. But in this view of the causes of the Revolution, the nature of the place, where those desirous of a change were assembled, must be taken into consideration. In countries, where the mass of the people have been long habituated to regard themselves as interested in the acts of the government, and privileged to express their wishes and opinions regarding those acts, it is impossible that the population of the capital, however numerous or intriguing, should possess an undue share of influence; but the case is different in countries where the people do not think themselves authorised or qualified to discuss the measures of their rulers, especially if the connection and communication between the capital and the provinces is by no means intimate, regular, and frequent. In such countries, the population of the capital gives the colour and tone to the feelings and actions of the population of the provinces; and whoever wields it, wields a machine, by means of which he may almost certainly succeed in overthrowing the government of the country. This was very strikingly the case in Paris, not merely from the political ignorance and bondage in which the people of France had long been kept, but also from the peculiar character of the population of the capital; in which, even before the Revolution, there was to be found a greater laxity of principles and conduct, and more intrigue, restlessness, and systematic depravity, than existed in any other capital of Europe. There was also in it a larger number of what are called men of letters, who would willingly lend their talents to the propagation and support of any doctrines, to the recommendation of any schemes or acts, however unjust or pernicious.

Influence of Paris.

It is not to be wondered at, therefore, if all the parties in the Revolution aimed principally at gaining over the population of Paris, which, both from its influence as the population of the capital of France, and from its peculiar fitness for being acted upon in such a state of things, could not fail to be of essential service to their views.

Character of the first movers of the revolution.

Those who first appeared as the leading actors in the tremendous drama of the French Revolution, were, it may be allowed, without any great stretch of candour, men who at least did not contemplate or approve of violent and unjust changes in the state; but at the same time it must also be urged against them, that they came to the task totally and lamentably unprepared for it; unprepared by their general ignorance of human nature—by their ignorance of the sound and practicable principles of government—and most of all, by their ignorance of their own unfitness, and of the total want of preparation in the French people, even for gradual and moderate reform. Thus ignorant, they roused and armed the worst passions of the multitude; they instilled into them a love of change, and they taught them their own power. The consequences were such as might be expected, when we reflect on the character of the population of Paris, on whom they at first acted, and who afterwards became the instruments of more daring and unprincipled leaders.

Still, however, it must be admitted, that it is difficult to trace the formation, or understand the real features of the characters of such men as Roberspierre, Danton, Marat, &c. That they were almost unparalleled in cruelty; that they had no conception of the obligations of truth and justice, is too apparent: but these horrid qualities were strangely mixed with some species of patriotism; and even in the midst of unlimited power, they seem to have had little or no ambition, and certainly made no attempts to enrich themselves.

Causes of the military success of the French.

II. With respect to the causes of the wonderful military successes of the French, it appears to us that three causes principally contributed to these successes.

In the first place, long previous to the revolution, certainly as far back as the reign of Louis XIV. the French nation of all ranks and classes, the poorest and most oppressed equally with the richest and most highly privileged, have been distinguished by their love of glory, and by a hope, sometimes weak and evanescent, at other times strong and prevailing, but never totally extinguished, that their nation was destined for universal empire. This has been their predominant and characteristic passion; and this passion has been strengthened and encouraged by all the circumstances of the Revolution.

National glory.

National independence.

For, in the second place, there came in aid of this passion, the strong feeling of national independence, which all nations, even the most barbarous and enslaved, possess in a greater or less degree. We have already stated our belief, that the bulk of the French people were so ignorant, and had been so long habituated to political slavery, that they could form no idea of political liberty; and consequently to promise it to them, was to promise them that which could neither excite their hopes nor enter into their conceptions. But, as soon as they understood that their country was about to be attacked, that powerful and almost instinctive love of national independence, which operates in the breasts of the inhabitants of all countries, broke forth in an enthusiastic determination, not to allow foreigners to invade and overrun their country. In the case of France, too, this love of national independence was greatly aided by their love of national glory. They could not brook the idea, that France, the Great Nation, destined for universal empire, should become the vassal state, or even the temporary and degraded conquest of any foreign power. Besides, as the mass of the people had tasted of some of the beneficial effects of the Revolution, in the abolition of feudal services, and of those oppressions which are much more acutely and generally felt, than the want of political independence and liberty, by the people at large, in all countries, they were roused to defend the cause and existence of that Revolution; knowing, that if they did not succeed, they would be reduced to their former state of degradation and misery.

Talents brought into action.

In the third place, it was of the very essence of the Revolution, to create, or, more properly speaking, to nourish and bring forth to notice, and reward, talents of every description; and these talents were directed with single and undeviating energy and perseverance to one end. The military ardour, which was at first excited by the love of glory, and the wish to be instrumental in rendering France mistress of the world, and by the determination not to permit foreign nations to destroy her national independence, or the effects of the Revolution, was cherished and strengthened by the conviction that the path to the highest commands was open to talents and merit. Thus her armies were filled with soldiers, who despised death, and who fought with that enthusiasm which such passions and hopes naturally produced; while they were led by officers, selected solely on account of their merit and fitness, for the command to which they were appointed. At the head of the government also, there were, at almost every period of the Revolution, men admirably calculated to direct the efforts of the great machine which the Revolution had put in motion. Even the despotic and arbitrary nature of this government, such as it existed in the time of Roberspierre, contributed to the success of their arms; for it was the energy and secrecy of despotism directing the enthusiasm of the love of glory and national independence.

When we reflect therefore on the operation of all these causes; that nearly the whole powers, both mental and corporeal, of a populous nation, were directed to one object, in the attainment of which all were convinced they had the highest interest, and that all classes were further stimulated to exertion and perseverance, by the knowledge, that, while they were securing the national interest, and the liberties which the Revolution had brought them, they were treading the path which would certainly conduct them to a higher rank and influence in the state than they previously possessed, we shall not be astonished at their military successes. But, in order more thoroughly to develope the causes of these successes, we should reflect on the enemies they had to contend with. In the first place, the people of most of the countries which they invaded were disposed to receive them as friends, from a belief that they came to destroy all the oppressions under which they suffered. In the second place, the councils and armies of their opponents were directed by much inferior talents, and by men who, besides their inferiority in talents, did not feel the operation of the same powerful motives for exertion and perseverance. There is also good reason to believe, that many of them proved traitors to their country, and fell before the influence of French gold, not less than by the superiority of the French arms. Lastly, France was a single power against a combination of powers; the pressure of every defeat, brought into more close and compact union all the members that formed her commonwealth, while success, speaking powerfully to their love of national glory, equally produced the same effect. On the contrary, the combined powers had within them the elements of discordance and disunion; they were jealous of each other, and strongly disposed to separate, either after defeat or success. Their sense of the common danger to which they were all exposed from the French Revolution, was not sufficiently strong, or so continually present to their apprehensions, as to banish their mutual jealousy; while their selfish views too plainly proved, that if they succeeded in putting down the Revolution, they would not fail to quarrel among themselves about the spoil. Such appear to us to have been the principal causes which produced the military successes of the French. On their side, great enthusiasm, great talents, great exertion and perseverence, the strong motives of personal ambition, and the love of national glory and independence, all operating to one single object. On the side of the allies, talents neglected, and prejudices hurtful to their cause persevered in; no common bond of union; mutual suspicion and jealousy; an inadequate sense of their own danger; and treachery and disaffection among their subjects.

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Causes of the establishment of military despotism in France.

III. With respect to the change of the French government, from a democratic form at least to a military despotism, it will be found, on examination, not to have been great in reality, and that the change which actually took place was produced by the operation of very simple and natural causes.

In the first place, the real change was not great; for it would be difficult to point out any period of the Revolution, in which the people were not subjected to a most arbitrary government—a government which well fitted them even for a military despotism. We shall not examine whether the state of France, threatened by numerous foes from without, and convulsed with intestine divisions, did not require and justify the arbitrary and severe government which was exercised over it; the cause or justification of this government is not now the object of inquiry. The fact is indisputable, and it accounts, in our opinion, for the ease with which the French passed from the forms of a democratic government, to a military despotism. Besides, we should always recollect, that the French people had no conception of political liberty; and if some idea and love of it sprung up, at the commencement of the Revolution, it was smothered by the tyranny and oppression which soon succeeded.

In the second place, the real change which took place from the form of democracy to military despotism, may be traced to obvious and satisfactory causes. The national love of glory disposes all Frenchmen to a military life; and throws round the military character a splendour which conceals its tyrannical and oppressive nature. This splendour round the character of Bonaparte was, to the eyes of Frenchmen, of the most brilliant and dazzling kind: he had gone further towards the realization of their fond hope, that France would attain universal empire, than any of their monarchs, and therefore they not only submitted, but were favourably disposed, to the military government of a man who had done so much, and who, when their actual sovereign, they hoped would perfect the great undertaking which they had so near their hearts. A people whose fondest wishes were centered in national glory and universal empire, could not but be attached to a military government, as the best suited to the accomplishment of those wishes, and to a man who they knew would conduct that military government with the greatest skill and success. Even those who were not infected with this national and characteristic passion, hailed Bonaparte as the man who had put an end to the convulsions that had so long agitated France; and though they still apprehended that his character, and the character of the people at large, would keep France in almost continual war, yet they at the same time trusted that, under him, the internal state of the kingdom would be quiet, and they would at length be freed from a rapid succession of tyrants.

But there was another circumstance that reconciled the French people to a military government,—from the extension and long duration of the military system, a large portion of the population were interested in it. Their relations and friends were in the army; and if France were to become pacific, or if her government were not military, they would be thrown useless and unsupported on the world. Thus the same causes, which in part contributed to produce the military successes of the French, operated to render them fit subjects for a military government; and the Revolution, by increasing and calling into more energetic and general action their love of glory, as well as by destroying all the habits of settled and regular life, also fitted them for a government which would cherish and flatter that love, and indulge their restless and irregular habits.

We shall defer at present the consideration of the effects on the character and condition of the French produced by the Revolution, as some of these effects were greatly heightened by the operation of the system which Bonaparte established and acted upon after he became Emperor; and therefore the subject will afterwards fall more properly under our notice. We shall now resume the history.

Moreau had long been the object of Bonaparte's hatred and jealousy; but no opportunity occurred of crushing or removing him, till the spring of 1804, when, in consequence of an accusation that he was implicated in a design to restore the Bourbons, he was seized and sentenced to be imprisoned; but his popularity with the army was so great, that Bonaparte commuted this sentence to banishment for life to the United States of America.

Campaign of 1805.

Symptoms of approaching hostilities with Germany had been long apparent in France; but Bonaparte did not leave Paris to put himself at the head of his armies till the 24th of September 1805. As soon as he reached this place, he issued a manifesto denouncing what he called the third coalition, which he attributed to the gold and hatred of England. As the operations and result of this war are detailed in the History of AUSTRIA, we shall run rapidly over them here. The French army consisted of five divisions: they crossed the Rhine the day after Bonaparte reached Strasburg. Hostilities commenced on the 7th, when the Austrians were defeated in attempting to oppose the passage of part of the French across the bridge of Donawert. The main Austrian army was under General Mack; but his conduct, either from incapacity, or from the interference of the council of war at Vienna, was such, that the French advanced rapidly with upwards of 200,000 men, while he had not above 80,000. Swabia, Franconia, and Bavaria, were overrun in a very short time. Mack was entrenched at Ulm, where, on the 15th day of October, the 3d day after firing the first shot, his army was so dreadfully beaten, that he was obliged to capitulate on the 17th. The Archduke Charles, at the head of 95,000 men, in vain endeavoured to prevent this dreadful disaster, by a rapid march from Italy; but coming up too late, and not being sufficiently strong to oppose Bonaparte, the latter pushed on towards Vienna, which he entered on the 12th of November. Austria, having been joined by Russia, resolved to hazard the fate of another battle, which was fought at Austerlitz on the 27th of November. The engagement commenced at sunrise: in less than an hour, the left wing of the allies was entirely cut off; and this was the forerunner of their total defeat. On the 5th of December an armistice took place, which was followed by the treaty of Presburg, on the 26th of that month. By this treaty, France was confirmed in the possession of all her conquests beyond the Alps, which had formerly belonged to Austria. Bonaparte was recognised as King of Italy; and to this kingdom the Emperor of Germany ceded his part of the states of Venice. The Electors of Bavaria and Wirtemburg, having been made kings by Bonaparte, were recognised as such by the Emperor; and the Tyrol and Swabian principalities of Austria assigned to them.

Battle of Austerlitz, Nov. 27.

Treaty of Presburg.

Bonaparte, on his return to Paris, stopt at Munich, where his son-in-law, Eugene Beauharnois, was married to the King of Bavaria's daughter. Having arrived at his capital on the 2d of March 1806, he opened the sitting of the legislative body by a speech, in which he inveighed against England, as having fomented the late war, the third coalition, which however he had succeeded in destroying, and thus adding to the glory of France. The whole peninsula of Italy had been added to the French empire; Russia had been obliged to retreat to her own territories; Austria had been saved by his clemency; Spain continued faithful; with England he desired peace on the basis of the treaty of Amiens.

Extent of the French empire, A. D. 1806.

In the annual exposé, the extent and power of the French empire at this period were described. Besides the 110 departments of France itself, there were under the protection of the Imperial Eagle, Holland, Italy, Venice, Istria, Dalmatia, and Naples. The allies of France were, Bavaria, Wirtemburg, and Baden, besides several other of the principal powers in Germany. Each succeeding coalition which England had formed, had only increased the power and the territory of the French. By the first, they had gained Belgium, and the boundary of the Rhine; the union of Holland with France, and the conquest of those states which now formed the kingdom of Italy. The second had put them in possession of Piedmont. The third had added Naples and Venice. The exposé concluded, with expressing Bonaparte's desire for peace, as he had exhausted military glory, and wished now for repose, in order that he might devote himself to the improvement of France, and the happiness of his people. On the 31st of March, several acts were presented to the senate, among which were those for annexing the city and territories of Venice to the kingdom of Italy; for placing Joseph Bonaparte on the throne of Naples; for conferring the principality of Neufchatel on Berthier; and titles of high distinction, principally taken from places in Italy, on his most distinguished generals. At the same time, Eugene Beauharnois, the son of Josephine, was appointed Viceroy of Italy.

Still the ambitious projects of Bonaparte were not satisfied; and he directed, or ordered, the government of Holland to petition for the honour of being placed under one of his family. Louis Bonaparte was accordingly proclaimed King of Holland.

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Early in the year 1806, Mr Fox became Prime Minister of Britain, in consequence of the death of Mr Pitt, and he immediately began to put into execution such measures as he thought were likely to bring about a peace with France, the object that had always been nearest his heart. The particulars of this negociation are given in the History of BRITAIN, and therefore need not be repeated here. It is sufficient to observe, that it did not produce peace; that Russia refused to ratify the treaty which her minister had made with France; and that before the Earl of Lauderdale, the British Ambassador sent to Paris for the purpose of negotiating, had left that capital, Bonaparte had departed to put himself at the head of his armies against Prussia.

War between France and Prussia.

For some time past, the King of Prussia had given himself up to the interests and influence of Bonaparte, and had even shared in his unjust spoils, by annexing Hanover to his dominions: but in the negociations with England, it was understood that England had required the cession of Hanover from France, and that France had agreed to yield it. This irritated the King of Prussia, who was thus convinced that Bonaparte regarded him merely as a vassal Prince, and perhaps as one whom he would destroy when he had accomplished more grand and serious undertakings. Prussia was also alarmed at the Confederation of the Rhine, which Bonaparte had formed; and which, being under his controul, was either meant or at least calculated to curtail his power, and keep him in awe. The King of Prussia, moved by these considerations and apprehensions, prepared for war; and Bonaparte did not seem sorry that hostilities were to commence, nor anxious to pacify the King. On the 24th of September, Bonaparte left Paris, to put himself at the head of his armies. The discussions, however, were still continued till the 5th of October, when both monarchs were at the head quarters of their respective troops: a few days afterwards, a declaration of war was published by Prussia. The King was so confident in his own strength, that just before the commencement of hostilities, he refrained from any attempts at reinforcement from other powers.

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The French army advanced in three divisions; the right, under Ney and Soult, with some Bavarian troops, advanced on Hoff; the centre consisted of the reserve, under the Grand Duke of Berg; the corps of Bernadotte and Davoust, and the imperial guards, marched to Gera; the left, under Lannes and Augereau, took the route to Cobourgh. The Prussian army had taken a strong position along the north of Franckfort on the Maine; but this they were compelled to leave, in consequence of the French unexpectedly turning their left wing, and took up a position near Jena. Here they were attacked by the French on the morning of the 14th of October, and in less than an hour the action became general. The force on each side was nearly equal, comprizing about 250,000 men, and 700 pieces of cannon. At one period of the battle, the issue was doubtful; but it was turned in favour of the French, principally by a charge of their dragoons and cuirassiers. The Prussian infantry, unable to resist them, were broken and thrown into confusion, the day was lost, and the Prussian army nearly annihilated, 40,000 being killed, wounded, and taken, including about 20 generals; among whom, the Duke of Brunswick was mortally wounded. In consequence of this victory, Erfurt, Magdeburgh, and Stettin, all places of great strength and importance, were reduced; and on the 27th of October, Bonaparte arrived at Berlin. The only part of the Prussian army which did not immediately yield, or was not utterly dispersed, was the division under Blucher, who displayed wonderful activity and courage in his retreat to Lubec, where, however, he was obliged to capitulate.

The King of Prussia, thus deprived of his whole army, retreated first to Custrin, and afterwards to Koningsberg, where he awaited the arrival of the Russians, without whose assistance he had imprudently engaged in the contest.

Those Princes of Germany who had joined the King of Prussia in this short and unfortunate war, were severely punished by the conqueror. The Elector of Hesse, and the young Duke of Brunswick, were deprived of their dominions; Mecklenburg was taken possession of; the Elector of Saxony, however, was pardoned, as he had been compelled to act against France. Hanover was occupied; and Fulda, Cassel, and Hamburg, were taken possession of in the name of Bonaparte.

Battle of Pultusk. Dec. 26.

In the mean time, the Russian army destined for the support of Prussia, had crossed the Vistula under general Benningsen. The French also advanced into Poland, and, by their manœuvres and superior force, obliged the Russians to recross the Vistula. Their retreat, however, having enabled them to join strong reinforcements, they again advanced, and fixed their head-quarters at Pultusk. Here, on the 26th of December, a dreadful battle was fought, which continued for some time with considerable vicissitude; but at length terminated in the defeat of the Russians, who fell considerably back. Bonaparte, however, found his army so much weakened by his dearly bought victory, that this circumstance, and the severity of the winter in this country, induced him to go into winter quarters. The King of Prussia, still more dispirited by the misfortunes of his ally, endeavoured to procure peace, but in vain.

It has already been mentioned, that Bonaparte had made his brother Joseph king of Naples. It may, however, be proper briefly to narrate the events, which deprived the legitimate monarch of his throne. He had lately made peace with Bonaparte, but by permitting an Anglo-Russian army to embark at Naples, which was to act against France, he incurred the displeasure of Bonaparte. Joseph Bonaparte was sent with an army against him; the Neapolitan troops could make no resistance; the kingdom was in a very short time overrun and subdued; and Joseph Bonaparte entered his capital in triumph.

Battle of Eylau, A. D. 1807.

Although Bonaparte, after the battle of Pultusk, deemed it necessary to go into winter quarters with his main army, yet the rest of his forces were by no means idle. Silesia was invaded; and on the 8th of January 1807, Breslau surrendered. The other fortresses in this country did not hold out long afterwards. Other divisions of his army were employed in besieging Stralsund, Colberg, and Dantzic. But the efforts of Bonaparte were principally directed against the Russian army, which early in 1807 was in great force. About the end of January he quitted Warsaw, (where he had done nothing towards the re-establishment of Poland, though by promising this he had gained over the Poles to his interest,) and joined his army. Operations immediately commenced, the result of which was, that the Russians were obliged to retreat, and take up a position behind Eylau. Here Bonaparte attacked them; the contest was desperate. At one period of it, a thick fall of snow intercepted the view of the French divisions, and for a considerable time they were exposed to extreme uncertainty and danger. At length Marshal Davoust succeeded in outflanking the Russians, who retreated, but not in the least disorder. (See England.) Both parties claimed the victory; in fact, the battle was indecisive, except so far that the French compelled the Russians to retreat on the day when it took place; for they in their turn, instead of passing the Pregel in pursuit of the enemy, or pushing on to Koningsberg, retired to their entrenchments. Soon afterwards, the Emperor Alexander, and his brother Constantine, joined the Russian army with upwards of 60,000 troops; and Bonaparte ordered strong reinforcements from France and Germany.

In the mean time, the siege of Dantzic was prosecuted with great vigour, and it was obstinately defended. The garrison consisted of 16,000 men. On the 24th of April the bombardment began; and in one night three attempts were made by the French to gain the citadel, but they were ineffectual. As the relief of this place was an object of great importance to the allies, they resolved to attempt it: the Russians first advanced for that purpose, but they failed, and suffered a very severe loss. The Prussians next endeavoured to penetrate to Dantzic, but they were soon obliged to abandon their enterprise. On the 21st of May, every thing being prepared for the assault, the governor, (his garrison being reduced to 9000 men and there being no hope of relief,) agreed to surrender. This conquest was of great importance to Bonaparte, as Dantzic strengthened the left wing of his army, while the centre was supported by Thorn, and the right by Praga.

Surrender of Dantzic.

As Bonaparte found that the forces of Russia were more formidable than he expected, he endeavoured to reduce the number of his enemies, by detaching Sweden from the allies; but not succeeding, the war against that power was carried on in Pomerania with such vigour and effect, that the Swedish general agreed to an armistice, which, however, was to be submitted to his Swedish Majesty. He did not approve of it, and resolved to take the command of the army himself. As soon as he landed in Pomerania, he directed his thoughts to the fortifications of Stralsund, which the French were at that time besieging. His army consisted of about 30,000 Swedes, and 4000 Prussians. But we must suspend our account of his operations, till we bring the narration of the contest between the French and Russians to a close.

Operations against Sweden.

Bonaparte, after the battle of Eylau, and the fall of Dantzic, resolved to strengthen his positions, that he might be able to resist the attack of the Russians, who now seemed disposed to become the assailants. On the 5th of June, the Russians did attack them, and gained some advantages. On the 8th, Bonaparte arrived and took the command. He immediately ordered an attempt to be made to recover the positions they had lost; the French were successful, and not only regained their positions, but forced the Russians to fall back. From the 5th to the 12th of the month, there had been constant engagements, in which the loss was very considerable on each side. On the 13th, Bonaparte had pushed the Russians back to Friedland. Here, on the 14th, the anniversary of the battle of Marengo, he determined to attack them. The battle lasted from five in the morning till seven at night. At the close of the day, nearly all the French force fell on the centre of the Russians: It gave way, and they lost the battle. Their loss was very great, and they were pursued as far as the Niemen, where they were joined by large reinforcements from Russia. In consequence of this, the Russian general resolved to hazard another battle, and crossing the Niemen, stationed his army on a great plain to the right of the town of Tilsit. The fall of Koningsberg was the immediate consequence of the battle of Friedland, the garrison evacuating it, and joining the Russian army.

Battle of Friedland, June 14. 1807.

While Bonaparte was advancing towards Tilsit, an overture was made by the Russian general Bemingsen to the Duke of Berg, for an armistice. On the 22d of June, it was signed; and, on the 24th, an interview took place between Bonaparte and the Emperor of Russia, on a raft on the Niemen. On the 9th of July, the peace between Russia and France was ratified. The conditions of this treaty more immediately connected with the history of France are, that East Friesland was to be added to the kingdom of Holland; a new kingdom, under the title of that of Westphalia, was to be formed out of the provinces conquered from Prussia, at the head of which Jerome Bonaparte was to be placed; the kings of Holland and Naples, and the confederation of the Rhine, were acknowledged; and Russia and Prussia agreed to shut their ports against England, and become a party in the maritime war, the grand and favourite object of Bonaparte, by means of which, and the exclusion of British commerce from the continent, he foolishly hoped to reduce Britain to a compliance with his terms.

Peace of Tilsit.

The peace of Tilsit was not immediately followed by the cessation of hostilities between France and Sweden; but as Bonaparte had now no other enemy against whom to direct the immense force he possessed in the north of Europe, it was not to be expected that Sweden could long resist him. The King of Sweden finding that his efforts for the defence of Pomerania were unavailing, returned to his capital; and on the 7th of September, a convention was signed between the Swedish and French commanders, by which the latter were put in possession of Rugen, and the other Swedish islands on the German coast.

Convention with Sweden.

During the absence of Bonaparte from France, a message was communicated to the senate in the month of March, stating, that it was necessary to anticipate the conscription of 1808; but that the conscripts would be permitted to remain in France for six months, to be trained and disciplined, after which they would be liable to be called to the theatre of war. This is the first instance of the anticipation of the conscription, a measure which was afterwards frequently resorted to. Very soon after Bonaparte's return to Paris, he addressed the legislative body and the tribunate on the situation of the empire, the conquests which France had atchieved, and his desire for a maritime peace.

As the Dutch bore impatiently the loss of their commerce, and as Louis was disposed to commiserate them, Bonaparte obliged him to issue very severe decrees against the introduction of British goods; and in order to shew to the world what a mere puppet of a king he was, the strong fortresses of the Maese, the great bulwarks of Holland against France, were taken within the limits of the latter. He next prepared for the invasion of Portugal, and an army of 40,000 men was ordered to be assembled at Bayonne. This, however, was for the present productive of no consequence, except the emigration of the Prince Regent of Portugal to the Brazils.

Bonaparte's scheme against Spain.

Although the King of Spain had long shewn himself the willing instrument of Bonaparte, and the resources of that country were entirely at his disposal—although he had proved his devotion in such a dreadful manner to himself, by engaging in a war with Britain, that had nearly completed the ruin of his kingdom,—yet Bonaparte was not content. The ambition of placing his brothers and relations on the thrones of Europe had seized him; and though Joseph Bonaparte was made king of Naples, yet he resolved to remove him to Spain, and place Murat, who had married his sister, in his place. His designs on Spain had another object. While she remained under her imbecile government, though that government was sufficiently disposed to act under his guidance, yet the resources of the kingdom were in such a dilapidated state, and there was so little energy either in its councils or people, that the co-operation of Spain was of little benefit to the furtherance of his views, especially against Britain. The dethronement of the King of Spain, and the accession of Joseph Bonaparte, were therefore resolved upon. The means which he employed to persuade the King to resign his throne in favour of his son Ferdinand, and to entice Ferdinand into France, and to surrender his claims to him,—the insurrection of the Spaniards,—their answered calls to Britain for assistance,—the battles that were fought between them and the French,—the retreat of Sir John Moore,—and the masterly operations, and brilliant victories of Lord Wellington till the reduction of Ciudad Rodrigo on the 19th of January 1812, are fully detailed in the History of BRITAIN. We shall therefore omit those parts of the history of France which relate to the operations of her army in the Peninsula, till we come to the events of that year; and confine ourselves, in the intermediate period, to the operations of Bonaparte in the other parts of Europe, and the internal transactions of France.

The same system of concealment and misrepresentation which Bonaparte had practised respecting all his reverses, he extended to the affairs of Spain. In 1808, when Joseph Bonaparte was obliged to leave Madrid, not a word was said of Spain in the Moniteur. But his reverses, and the enthusiasm as well as the extent of the opposition to him in the Peninsula, were well known in all parts of Europe; and, as might be expected, received with satisfaction and joy. Austria, who had reluctantly submitted to the last peace, had been for some time employed in bringing her finances into order, and in forming magazines on her frontier. These circumstances did not fail to excite the suspicion of Bonaparte; and a long correspondence took place on the subject between the Austrian ambassador at Paris, and the French minister for foreign affairs; but the Austrians persevered in their military preparations, notwithstanding the remonstrances, and even the threatening language of the latter. Orders were therefore transmitted from Paris, to the members of the Confederation of the Rhine, to call out their respective quotas of troops, 80,000 of whom were taken into the pay of France, and sent into that country to replace those French troops whom it was found necessary to send into Spain.

ustria prepares for ar. .D. 1808.

Under the circumstances in which he was placed, it was of great importance for Bonaparte to secure the neutrality of the Emperor of Russia; a conference, therefore, took place between them on the 27th of September, at Erfurth, in the former electorate of Mayence. The Emperor seems to have entered into the views of Bonaparte, and the latter in return agreed to evacuate the Prussian territories, as soon as the contributions, which he reduced to one third, were paid up. By this concession to the wishes of the Emperor of Russia, Bonaparte set at liberty a great number of his troops, who were instantly marched for the Peninsula. The two sovereigns also agreed to propose peace to Britain, but, as we have already noticed in the history of that country, the proposal was rejected.

This year did not pass over, without new and additional proofs of the rapacious and unsatisfiable nature of Bonaparte's ambition. The military posts of Kehl, Wesel, Cassel on the Rhine, and Flushing, were annexed to France on the east and north; while on the side of Italy, Rome, Parma, Placentia, and Ancona, suffered a similar fate.

Though Austria had been long preparing for the renewal of hostilities with France, yet she did not issue a formal declaration of war till the 6th of April 1809. At this period she had an army consisting of nine corps, each corps consisting of 30,000 men: the first six were under the immediate orders of the Archduke Charles; the seventh was under the Archduke John in Poland. Besides these, there were two corps of reserve, one of 20,000 men commanded by Prince John of Lichtenstein; the other of 10,000, under General Kinmayer; and about 25,000 partizans in the Tyrol, Carinthia, and on the confines of Bohemia. The French were not inferior in respect to numbers, and they occupied the following positions; a corps entirely of French at Ratisbon, under Marshal Davoust; another under Massena at Ulm; and a third under Oudinot at Augsburg: three divisions of Bavarians were posted at Munich, Landshut, and Strasburg: the Saxons were encamped under the walls of Dresden; and the Poles near Warsaw.

State of her armies, A. D. 1809,

and of those of France.

As soon as Bonaparte learnt that the Austrians had crossed the Inn, he left Paris on the 13th of April; on the 17th he arrived at Donawert, where he fixed his head quarters; on the 19th, the different corps of the French began to unite. At Ingolstadt the plan of Bonaparte was unfolded; which was to manœuvre on the Austrians, whose line was extended from Neustadt to Landshut; to break the line, and come between the Archduke Charles and the corps commanded by his brother. In consequences of the successes of the French, particularly at Eckmuhl, the Archduke was forced to cross the Danube at Ratisbon, in order to form a junction with General Bellegarde, who had been employed in keeping the French in check, on the frontier of Bohemia. The Archduke finding he could not defend Ratisbon, was obliged to continue his retreat; and Bonaparte, following the course of the Danube, advanced rapidly towards Vienna; on the 10th of May, he appeared before this city, which, after some show of resistance, he entered. In the mean time, the Archduke Charles, having learnt the fate of Vienna, moved down on the left bank of the Danube, for the purpose of watching the motions of the French; and fixed his head quarters, on the 16th of May, at Ebersdorf. Bonaparte immediately formed the design of attacking him here, and for this purpose marched along the south bank of the river, till he reached the distance of about six miles from Vienna, at which place its breadth and rapidity are broken by two islands. At this point he resolved to cross it. As the French advanced the Archduke retreated, and the right wing of the former was posted near the village of Essling, while the left was supported by the village of Aspern. Here on the 21st and 22d two dreadful and sanguinary battles were fought: the battle of the 21st was terminated only by the darkness of the night, at which time the French were driven from Aspern, but still retained Essling. On the morning of the 22d they regained Aspern; but by repeated attacks, the Austrians succeeded in driving them both from it and Essling. In the night between the 22d and 23d, they retreated from the left bank of the Danube, and took up a position on one of the islands.

Bonaparte enters Vienna.

Battles of Aspern.

In the mean time, the war was proceeding in Italy, where the Archduke John, and the Viceroy Eugene Beauharnois, were opposed to each other. At first the Archduke was successful; Padua and Vicenza were taken, the Adige crossed, and Venice threatened; but the Viceroy having been reinforced, retook Padua and

Operations in Italy.

Vicenza, crossed the Brenta, and drove the Austrians before him. At this period, these hostile armies were sent for, in order to reinforce the grand armies on the Danube; but as they were proceeding towards Austria from Italy, they met at Raab, where a severe engagement took place on the 14th of June, the anniversary of the battle of Marengo. The battle began at two o'clock in the afternoon, and though the French were superior in numbers, victory was long doubtful; at length, the troops of the Hungarian insurrection, unaccustomed to service, gave way, and the Austrians were forced to save themselves by flight. The Archduke Charles retreated to Comorn, in order to secure his junction with the grand Austrian army; while the Viceroy about the same time accomplished the same object.

Battle of Wagram, 5th and 6th July, 1809.

On the 4th of July, the whole army of Bonaparte was concentrated in or near the island in the Danube, where the Archduke Charles had not deemed it prudent to attack them. Bonaparte, having been reinforced by the Viceroy, resolved to cross the river, and try the issue of another engagement with the Archduke; for this purpose, in a very short space of time, three bridges were thrown across it, by which he intended to pass, and another bridge opposite to Essling, erected in order to draw off the attention of the Archduke to this quarter. In the short space of two hours, during the night of the 4th, while the Austrians were expecting to be attacked on their right, near Essling, the French passed the Danube, and on the morning of the 5th appeared drawn up on the left of the Austrians. This masterly manœuvre, by which the Archduke had been completely deceived, gave Bonaparte a great advantage; which he did not fail to profit by, in the obstinate but decisive battle of Wagram, which was fought on the evening of the 5th and during the 6th of July. During the first movements on the former day, the Archduke was obliged to give up his entrenchments; and on the 6th, Bonaparte, having strengthened his centre, attacked the weakened centre of the Austrians; the consequence was, that the latter gave way, and the wings, being thus exposed, also retreated. After this battle, all thoughts of serious resistance to Bonaparte were given up. Proposals for an armistice were carried to him from the Emperor Francis, which was agreed to, and signed immediately. By one article it was stipulated, that the Austrians were not to afford any succour to the Tyrolese.

The Tyrolese.

These brave and bold mountaineers, as soon as they learned the rupture between France and Austria, resolved to use their utmost efforts to shake off the yoke of Bavaria. At first they were successful; the Bavarian troops, though 27,000 strong, having been defeated by them. A still greater force was then sent against them under Marshal Le Febre, consisting of French, Bavarian, and Saxon troops. These they could not venture to meet in the field, but, taking advantage of the nature of their country, they destroyed thousands of them as they passed through the gorges of the mountains, by precipitating masses of rock on them. When, however, the armistice was concluded between France and Austria, their cause became hopeless, though they continued, for some time afterwards, to fight obstinately for their national independence.

Peace between Austria and France.

On the 14th of October, a treaty of peace was signed at Vienna between France and Austria. By this treaty, the latter ceded to the former all her sea coast; and the kingdoms of Saxony and Bavaria were enlarged, so as to become sufficient checks on her. Prussia was recompensed for her neutrality by the cession of part of Gallicia; and the Emperor Francis agreed to acknowledge Joseph Bonaparte King of Spain. Such were the leading articles of this treaty, that were communicated to the world at the time: but the Emperor Francis obtained these favourable terms only by a sacrifice of a domestic nature, which we shall afterwards have occasion to notice.

Bonaparte's speech to the legislature.

Soon after Bonaparte's return to France, the meetings of the legislature were opened by a speech from him. In this speech, the events of the year 1809, and the state of France at the close of it, were, as usual, the principal topics. He was marching, he said, on Cadiz and Lisbon, when he was under the necessity of treading back his steps, and planting his eagles on the ramparts of Vienna. Three months had seen the rise and termination of this fourth Punic war. He next adverted to the Walcheren expedition; and, in short and unsatisfactory terms, to the state of Spain. The annexation of Tuscany and the Roman states were next dwelt upon; but that part of the treaty of Vienna which had put him in possession of the Illyrian provinces, and thus brought the French empire contiguous to the empire of Constantinople, seemed the favourite topics of this speech. "I shall find myself in a situation," he observes, "to watch over the first interests of my commerce in the Mediterranean, the Adriatic, and the Levant. I will protect the Porte, if the Porte withdraws herself from the fatal influence of England. I shall know how to punish her, if she suffers herself to be governed by cunning and perfidious councils." In the course of 1809, Bonaparte had advanced one step towards blotting out even the nominal independence of Switzerland, by declaring himself the Mediator of that country. This he adverted to in his speech; and at the same time he hinted, that changes might become necessary in Holland, as she was equally injured by France and England, and yet was the *debouche* of the principal arteries of his empire.

Divorce Josephine

Bonaparte having thus succeeded in all his plans of aggrandizement except what regarded Spain, and being doubtless convinced that that country also would soon be reduced; having fixed all his brothers (except Lucien) on thrones, began to reflect on the probable fate of his own vast empire, on the event of his death. There was no probability of his having issue by Josephine; besides, even if there were, his power would be much more firmly consolidated, if he were united with some of the ancient sovereign families of Europe. Considerations of political ambition always weighed most in his mind; but by such a marriage, not only would his empire be strengthened, and, if there were issue from it, rendered secure after his death, but his personal vanity would be gratified. The divorce of the Empress Josephine, to whom he appears to have been much attached, was therefore agreed upon; and she, though equally attached to him, seems to have consented to this measure without reluctance. It took place in December 1809; but it was not till the 27th of February 1810, that it was publicly and certainly known whom he intended to marry. On that day, he announced, by a message to the Senate, that Berthier had been sent by him to Vienna, to demand for him the hand of the Archduchess Maria Louisa, daughter of the Emperor Francis. The ceremony of marriage was performed on the 11th of March at Vienna, the Archduke Charles representing Bonaparte on this occasion!

and marries Maria Louisa. A. D.

Early in 1810, Bonaparte began to unfold his designs upon Holland. A French army of 40,000 men occupied it; but at first he seemed disposed to be content with the annexation of only part of it,—the left bank of the Waal. As this, however, did not serve his purpose of totally excluding British goods, about the middle of June 20,000 French troops assembled in the neighbourhood of Utrecht, and on the 29th of that month the King of Holland received official information, that his majesty the Emperor insisted on the occupation of Amsterdam, and the establishment of French head quarters in that capital. Louis therefore resigned his throne, but at first only in favour of his son. Soon afterwards, however, Holland was annexed to France. As a justification of this measure, Bonaparte, in his message to the Conservative Senate, stated, that, in consequence of the English orders in council having destroyed the public law of Europe, new securities had become necessary, which could only be obtained by the annexation of the mouths of the Scheldt, the Meuse, the Rhine, the Ems, the Weser, and the Elbe, to France, and the establishment of an internal navigation between France and the Baltic. About the same time, the Hans Towns and the Valais were annexed to France; and the Count of Semonville, who brought up the report of the Senatus Consultum respecting these annexations, expressly pointed out the gratification and accomplishment of the views of Bonaparte, which were thus attained. "At length, after a struggle glorious for France, for ten years, the most extraordinary genius that ever nature in her munificence produced, had reunited, and held in his triumphant hands, the scattered wrecks of the empire of Charlemagne."

Holland annexed to France.

opulation the rench empire.

According to the plan of the annexation of Holland, Amsterdam was to rank as the third city in the French empire, Rome being the second. The whole population of Bonaparte's dominion, before the annexation of Rome, Holland, the Valais, and the Hans Towns, amounted to 38,080,443 persons, not including the military actually bearing arms. After these annexations, it was computed at 43,000,000. Hanover was annexed to the kingdom of Westphalia.

potic decrees.

To recruit the French armies, the conscription was again anticipated, 120,000 of the conscripts of 1811 being placed at the disposal of the minister of war for the service of 1810. During these measures, which plainly intimated that Bonaparte was resolved not to be content with the empire of Charlemagne, the most vexatious and despotic decrees were passed at Paris. By one of them, all servants of both sexes were obliged to register their names in a book kept by the Prefect of the Police. By another decree, the liberty of the press was utterly destroyed; the number of printers in Paris being reduced to sixty, and those in the departments in the same proportion; and the number of printing presses in the capital was to be only four, in each department only two. Another decree, respecting prisons, expressly declared, that there were many persons charged with crimes against the state, whom it was not safe either to liberate or bring to trial. But his most severe and frequent decrees were issued against the introduction of British merchandise into the continent. Not only were military governors appointed at the ports of Germany annexed to France, but at Dantzic, Colberg, &c. for preventing its introduction. General Rapp, who commanded the army employed on this singular service, had his head quarters at the former place. All English merchandize, whether taken by land or sea, was ordered to be burnt.

As, however, the prohibition of colonial produce created great dissatisfaction in his dominions, a decree was passed on the 25th of March, 1811, enjoining the culture of the beet root and the plant woad, to supply the place of the sugar cane and indigo; and so confident was Bonaparte of success in this scheme, that the prohibition of the sugar and indigo of the Indies, as English commodities, was announced for the 1st of January 1813.

Exposé for 1811.

On the 20th of April, the Empress was delivered of a son, for whom was revived the title of King of Rome. On the 17th of June, the French national ecclesiastical council was opened at Paris; the proceedings and result of which were kept a profound secret; but it is generally supposed that they were not agreeable to the wishes of Bonaparte. On the 29th of June the minister of the interior presented the usual annual exposé of the state of France. On these state papers no implicit confidence can be placed, as they evidently contain much of what is false, and much that is exaggerated; yet, by a careful comparison of them with one another, with what the other official papers furnish us with, and with what we know must have taken place, we may be able to glean some interesting and important facts from them. The exposé of this year states, that, "since the last session, the empire had received an addition of 16 departments, five millions of people, a territory yielding a revenue of 100 millions of livres, 300 leagues of coast, with all their maritime means. The mouths of the Rhine, the Meuse, and the Scheldt, were not then French; the circulation of the interior of the empire was circumscribed; the productions of its central departments could not reach the sea without being subjected to the inspection of foreign custom-houses. These inconveniences *have for ever disappeared*. The maritime arsenal of the Scheldt, whereon so many hopes are founded, has thereby received all the developement which it needed. The mouths of the Ems, the Weser, and the Elbe, place in our hands all the timber that Germany furnishes. The frontiers of the empire lean on the Baltic; and thus, having a direct communication with the north, it will be easy for us to draw thence, masts, hemp, iron, and such other naval stores as we may want. We at this moment unite all that France, Germany, and Italy produce as materials for the construction of ships."

This statement of the exposé deserves particular attention, as it at once points out the extent and resources of the empire of Bonaparte, at the period when it was at its greatest height; and demonstrates the extreme folly and madness of that ambition, which, not satisfied with such an empire, brought it to ruin by aiming at enlarging it.

Further enlargement of the French empire.

The restlessness of this ambition, which, when there was no opportunity for making real accessions to the French empire, employed itself in the nominal annexation of territories, which in fact had been before annexed, was displayed by the decree of the 5th of August; by which the territories belonging to the kingdom of Italy, situated on the left bank of the river that flows between Parma and Modena, were united to France, and its course, from its mouth to its source, was to be the future boundary between France and Italy, the boundary then proceeding along the Apennines to the frontiers of Tuscany.

On the 19th of September, Bonaparte left Compeigne on a tour to the coast; visiting Boulogne, where he caused the attack on the English frigate, noticed in the History of BRITAIN, and thence proceeding to Ostend, Flushing, and Antwerp, where he minutely examined all the works that were going on in the dock yards, and the ships that were building. From Antwerp he went to Amsterdam, whence, on the 13th of October, he issued a decree for assembling in council the deputies to the legislative body, from the Dutch departments. In consequence of this meeting, a number of decrees were issued, the most important of which were to the following purpose: The departments and their boundaries—the introduction of the French system of taxation into Holland, on 1st of January 1812—the establishment of two imperial manufactories of tobacco—roads with their tolls—canals—aqueducts for conveying water from Amsterdam to the Hague—the proportion of the budget in Holland for the year 1810, by which the revenue is fixed at 95 millions of livres, and the expences at 111 millions—the establishment of two academies and secondary schools, on the French plan, &c. Bonaparte returned to Paris on the 11th of November; and soon afterwards issued an order for the immediate call of 120,000 conscripts of the year 1812.

Bonaparte's measures in Holland.

Disputes between Russia and France.

This increase of his forces was occasioned by the disputes which, during 1811, had arisen between the Emperor of Russia and Bonaparte: the former, by the treaty of Tilsit, had agreed to exclude British goods from his dominions; but the consequences of this measure were so extremely prejudicial to the finances of his empire, already nearly exhausted, and to the interest of his nobles, many of whom depended entirely on the interchange of the produce of their estates for the merchandize of England, that Alexander was induced to connive at the infraction of the treaty in this respect. This gave umbrage to Bonaparte; and as Alexander, moreover, would not yield up Finland to Sweden, which Bonaparte required him to do, the difference was increased and exasperated. The whole year 1811 passed in negociations and discussions between France and Russia; but as neither party was prepared for war, hostilities were deferred. Bonaparte still saw the Peninsula not only unsubdued, but requiring almost constantly fresh troops; and the Emperor Alexander, fatally convinced of the ruin attending the commencement of hostilities, before every thing was planned and prepared, resolved not to commit himself hastily.

But though Bonaparte was afraid to act in a decidedly hostile manner towards the Emperor of Russia, the King of Prussia received no such scrupulous treatment from him. Indeed he seemed resolved to humble that monarch as much as possible; and obliged him, much against his will, to join the confederacy of the Rhine, and to place a considerable body of his troops under the orders of General Rapp, the French commander on the southern coast of the Baltic. This confederation was now extremely powerful: At the beginning of this year, the states composing it contained a territory of 5703 square leagues, with a population of nearly 15 millions; and the contingent of troops, which its 39 members furnished, was fixed at 118,682 men: these were taken, in the autumn of 1811, into the pay of France. See CONFEDERATION OF THE RHINE.

As the history of the war in Spain, which is given under the article BRITAIN, terminates with the reduction of Ciudad Rodrigo, in January 1812, we shall resume and continue it in this place.

Operations in Spain, A. D. 1812.

The preservation of Ciudad Rodrigo being of the utmost consequence to the French, Marshal Marmont marched to its relief; before he arrived, however, it surrendered. Lord Wellington's next enterprise was Badajos, which had been for some time blockaded by General Hill. This place was commanded by Philippon, a distinguished officer in the French service, especially as an engineer, and he left no means untried by which he could strengthen the fortifications, or impede the progress of the besiegers. Nothing, however, could withstand the valour of the British, who carried the place by storm, after suffering a severe loss, on the 7th of April. Soult had pushed forward to relieve this place, but as soon as he learned its fate, he commenced his retreat: his rear was closely followed by the British cavalry, and suffered considerably. On the 11th of April he evacuated the province of Estremadura entirely. In the mean time, Marmont had sat down before Ciudad Rodrigo, in the hopes of drawing off Lord Wellington from the siege of Badajos; but not succeeding in his object, and learning that his Lordship was advancing into Castile, he broke up from Ciudad Rodrigo, and advanced as far as Castel Blanco; but from this place he again retreated.

Badajos taken, 7th April, 1812.

In May, the head quarters of Marmont were at Salamanca, of Drouet at Aguaza, and of Soult at Seville. Lord Wellington was posted at Fuente de Guinaldo. His Lordship, at this time, formed a plan to cut off the communication between the French army of Portugal, and that before Cadiz; and, for this purpose, by a series of masterly manœuvres, he made himself master of the bridge of Almaraz, on the eastern side of the province of Estremadura. Here again Marshal Marmont was too slow in his motions, for he did not arrive till the bridge was in the possession of the English. The next object of Lord Wellington was Salamanca, before which some French troops were posted, but these retired on his Lordship's approach. Marmont, however, though he was not able, or did not deem it prudent, to attempt preventing the loss of Salamanca, resolved to attempt its recapture. Accordingly, he collected his army on the Douro, betwixt the 16th and 19th of June, and moved forward on the 20th. Lord Wellington did not refuse battle; but Marmont again retreated, retaining, however, a communication with some forts in the neighbourhood of the city, which still held out. Against these forts Lord Wellington directed all his efforts, and having reduced them, he pushed forward against Marmont. The latter retired, crossed the Douro, and took up a strong position on the bank of that river. This position appeared to Lord Wellington so strong, that, in order to draw Marmont away from it, he moved in such a direction, as seemed to threaten Madrid. The French general also, about the same time, endeavoured to carry into execution a scheme for cutting off the communication between the British army and Ciudad Rodrigo; and, for this purpose, having been reinforced, he moved in such a manner, as to threaten the left of the British. Lord Wellington, on seeing this, retreated a little, so as to render it secure; and Marmont being thus foiled, attempted to turn the right. Lord Wellington now manœuvred in such a manner, as would not only protect it, but enable him to take advantage of any blunder which Marmont might commit. Thus several days were spent. Marmont, constantly manœuvring to turn the right of the British, and Lord Wellington, making correspondent movements, in order to defeat his object. At last, Marmont, in his anxiety to out-manœuvre the British army, neglected the proper defence of his own, extending his line to the left, so far as to weaken the main body considerably. This fault Lord Wellington instantly perceived, and took advantage of it. The centre and left of the French were attacked with such successful and impetuous bravery, that they were soon beaten. The right would have as

Battle of Salamanca.

speedily shared the same fate, but it was reinforced by the troops that fled from the left, and held out till it was attacked in front, when it also gave way. It was now dark, but the French were pursued; and, during the battle and pursuit, suffered so severely, that only a few escaped to Valladolid. Marmont himself was wounded early in the battle.

Consequences of it.

Joseph Bonaparte had left Madrid with the army of the centre, in the hope of being able to join Marmont before his engagement with Lord Wellington; but, on learning the issue of the battle of Salamanca, he retreated in such a manner, as he trusted would draw off his Lordship from the pursuit of the defeated army. In this also he was disappointed, and Madrid was now abandoned to its fate. Nor was this the only result of the battle: Soult withdrew from the South of Spain; and the siege of Cadiz, which the French had continued so very long, was raised. The object of this general, as well as of Marmont, was now to compel Lord Wellington to abandon Madrid of which he had taken unmolested possession; and as they advanced with superior forces, and in such a direction as threatened to cut off his Lordship's communication with the other British forces in Spain, he evacuated the capital on the 1st of September, leaving a force under General Hill, which he hoped would be able to protect it; but Soult having joined Joseph Bonaparte, the English general found himself under the necessity of abandoning Madrid to its fate.

Lord Wellington, thus compelled to quit the capital, resolved, if possible, to bring Marmont to an engagement; but, previously, it was necessary to reduce Burgos. About the middle of September, operations were commenced against this place. The commander, fully sensible of its importance, and that, till it was reduced, Lord Wellington could not safely advance against Marmont, defended it with great skill and bravery. Little or no impression had been made on it, when his Lordship learnt that Souham, who had succeeded Marmont, was approaching with a large force, and that General Hill, after the loss of Madrid, was closely pressed by Soult. This intelligence induced his Lordship to abandon the siege; and, in his retreat, he was closely followed by Souham; and General Hill retreating in such a direction as to join his Lordship, and being followed by Soult, in a short time the two British and the two French armies were united. As, however, the latter were much more numerous than the former, they obliged Lord Wellington to continue his retreat to the confines of Portugal.

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At the close of the campaign, the French armies, exclusively of those which were wholly occupied by the desultory warfare of the Spaniards, consisted of about 104,000 men; of these, 72,000 infantry, and 2000 cavalry were under the command of Soult, who directed the armies formerly under the command of Joseph Bonaparte, and Souham. Suchet, in the south of Spain, had with him 18,000 infantry, and 4,000 cavalry, to oppose the Spaniards there, and an Anglo-Sicilian force, which had lately landed. Opposed to the French armies, were about 70,000 British, Germans, and Portuguese. But of the French, a large proportion consisted of young conscripts. With respect to artillery, the French were superior. The numerical force of their cavalry was also greater, but they were individually inferior to the British.

France and Russia prepare for war.

We have already mentioned the causes of the dispute between the Emperor Alexander and Bonaparte. As the discussions that took place in 1811, did not promise an amicable adjustment, Bonaparte prepared for war, by retaining possession of the Prussian fortresses in the north of Germany, and sending large bodies of troops there. Nor was the Emperor Alexander idle; he endeavoured, indeed, to prevent the recurrence of hostilities; but finding that impracticable, he used his utmost endeavours to render the resources of his vast empire available, in the event of a war with France, and he courted the friendship of Britain. The organization of the army was also improved. By these measures the Emperor Alexander saw himself, at the end of 1811, possessed of forces amounting to nearly 400,000 men, 300,000 of which he could bring against the French. When the dispute between France and Russia began, the forces which Bonaparte could have spared, in the event of an immediate war, were comparatively few; he therefore protracted the negociation, till he had assembled a more numerous, and, in every respect, a better equipped army, than he had ever before led into the field. The contingent of the confederation of the Rhine was augmented. The King of Saxony was called upon to join in the war, on the ground that Russia threatened the Polish possessions, which Bonaparte had given him. From the southern extremity of Europe, Murat marched his Italian troops. The King of Prussia reluctantly contributed nearly all his army; and Austria was called upon to fulfil her engagements, by which, in the event of a war, she was to support France. All the best troops that Bonaparte had in the Peninsula, were marched to the north of Germany. In short, all Europe, from the Pyrenees to the Baltic on its western side, and from the extremity of Italy to the same sea on its eastern side, and from the Atlantic Ocean to the confines of Poland, was leagued, under Bonaparte, against Russia. For such an immense army, about to invade a country nearly barbarous and desolate, it was necessary to provide enormous stores of provision, ammunition, &c. These were all brought up to the north of Germany, and such arrangements for their conveyance made, as Bonaparte expected would furnish him with a regular and full supply, till the Emperor Alexander was intimidated into submission. For there can be no doubt, that he expected, by the formidable nature of his preparations, or, at most, by the decisive blow which he firmly believed he should soon be able to strike, that Alexander would sue for peace, on such conditions as he chose to give.

Campaign of 1812.

Bonaparte crosses the Niemen.

On the 9th of May, Bonaparte having collected an army of at least 400,000 men, set out from St Cloud. On the 6th of June he crossed the Vistula. On the 22d of that month, he formally declared war against Russia; and two days afterwards, he crossed the Niemen, and entered the Russian territories.

Plan of the Russians.

Hitherto the Russians had made little or no resistance; but as they had marked out the first line of defence on the banks of the Dwina, it was supposed that there they would seriously oppose their invaders. The plan on which they had resolved to act was, however, different. Knowing the impetuous activity of Bonaparte, and that he had been accustomed to astonish and intimidate by the rapidity of his movements, and by advancing into the very heart of the country which he invaded, they hoped to draw him on into the interior of Russia, far from his resources, and to places where he could not support his army by plunder and contributions. They also anticipated the effects of a Russian winter, if he should be mad enough to continue in it till this season. In order that this plan should be carried into complete and successful execution, it was necessary that the inhabitants and soldiers of the invaded country should be such as the Russians were, both of them incapable of being seduced by the arts of the French,—even deaf to the promises of liberty, when that blessing was to come from an enemy. In short, the attachment, both of the Russian peasantry and the Russian army, to their Emperor and their country is so strong, that no temptation, no difficulty, can possibly shake it. But though the plan of the Russians was to draw Bonaparte into the interior of their vast, desolate, and barbarous empire, yet they at the same time determined to oppose him wherever they could do it with advantage, and thus weaken him as he advanced.

Bonaparte enters Wilna.

Such was the plan of the Russians, and they acted up to it with a patriotic perseverance which does them infinite honour. Bonaparte, indeed, was successful, in so far as driving back the Russians and advancing constituted success: he even succeeded in dividing one of the Russian corps from the main army. But as he advanced, he found no signs of intimidation on the part of the Emperor; no proof of attachment or submission from the people; and he must have been sensible that he was leaving his resources far behind, while he could not hope for regular and sufficient supply from a country never well cultivated or fertile, and now laid waste and deserted by the inhabitants as he proceeded. Those discouraging circumstances, however, did not appear so manifestly while he was in Poland and Lithuania, as the inhabitants of these districts, not attached to Russia, and regarding Bonaparte as their liberator, received him with gratitude and joy. On the 28th of June, he entered Wilna, which he did not leave till the 17th of July. His transactions during this stay are not clearly known; but though he was stationary, the different divisions of his army were on the advance. His plan now began to unfold itself, and he seemed to be aiming at once on the destruction of the main Russian army, and the occupation of Petersburg. On the latter enterprize, a corps under the command of Marshal Macdonald was sent. The rest of his army followed the line of the retreat of the Russians.

Battles at Witepsk.

Battle of Smolensk.

Battle of Borodino.

At Drisna, the Russians had an entrenched camp; but as the corps which Bonaparte had succeeded in separating had not yet come up, this was abandoned, and a position at Witepsk occupied. On the 24th of July, they arrived here, one of their corps having been previously dispatched to the north to cover Petersburg. On the 25th, 26th, and 27th, three battles took place; the Russians fought obstinately; and having succeeded in weakening the French, again retreated. In the mean time, Marshal Davoust, who had been sent after the Russian corps which was separated from the main army, came up with it, and brought it to action: but the result was not favourable to him, and he found himself so weakened that he was not able to prevent its rejunction. The French army which had marched on the route to Petersburg, was equally unfortunate. The plan of its general was to cross the Dwina, come round upon Riga, and thus cut off the communication with the capital. But in consequence of his losses on the 30th and 31st of July, in two very severe actions, he was obliged to recross that river, and the communication between Petersburg and the main Russian army was thus rendered secure. This army, on leaving Witepsk, retreated on Smolensk, Bonaparte still following them; but on account of the nature of the country, and the extreme difficulty of procuring provisions, he was obliged to disperse his different corps at a considerable distance from each other; he also began to experience another serious inconvenience. In other countries which he had invaded, he had been directed in his march, either by accurate maps, or by the information and guidance of the peasantry; but of this part of the Russian empire, there were no maps sufficiently accurate and minute for his purpose, and the peasantry fled at his approach. He thus advanced, ignorant of his route, and of the situation of his adversaries; and from these causes we find, even in the French bulletins, frequent acknowledgments that disastrous surprises took place. But the army suffered most from fatigue and want of provisions; so much so, indeed, that Bonaparte could not move from Witepsk till the middle of August. From this place he advanced to Smolensk, where he at length hoped to bring the Russians to a decisive engagement. They did wait for him here, but only till they had acted on their regular plan; for after having fought the French with great steadiness, and caused them great loss, they again retreated. Soon afterwards, the command of the grand Russian army was given to Kutusoff, who resolved to improve upon the plan of his predecessor, the Baron de Tolly, by offering a more steady and persevering resistance to the enemy, but still retreating, even after success. On the 18th of August, the French having thrown a bridge over the Borysthenes, crossed that river; and as it was now evident that the Russians meant to retreat in the direction of Moscow, Bonaparte endeavoured to cut them off from that place. In this attempt, however, he did not succeed at this time; and the divisions who were employed on this occasion suffered severely. The Russian general continued his retreat, till he arrived at Borodino, within a short distance of Moscow. Here the position was so extremely favourable for defence, though it did not cover the capital, that he resolved at length to try the issue of a general engagement with the French. Bonaparte, though he could have reached Moscow without fighting, preferred attacking Kutusoff. The force on each side was nearly equal, amounting to about 120,000 men; for already the French, by the obstinacy of Russian defence, the incursions of the Cossacks, who continually harassed their march, and the losses occasioned by disease, fatigue, and inadequate food, were reduced to this comparatively small number. The position of the Russians, naturally very strong, had been further strengthened by art; their line was protected by two heights, crowned with redoubts at 100 paces from one another; and the ridge was covered with artillery and infantry, for the purpose of supporting their centre. At six o'clock in the morning of the 7th of September, Bonaparte commenced the attack, by attempting to carry the Russian line by main force. The contest was murderous, but the issue unfavourable to the French; and while they were thus occupied, nearly 30,000 Cossacks cut their way into the centre of their camp, carrying confusion, disorder, and dismay, along with them. Bonaparte next ordered that an attack should be made on the heights; and this, after a most sanguinary contest, was partially successful. While these operations were going on in one part of the army, in another part the Russians were the assailants, and drove back the French. Thus the engagement continued with varying success till night; and though the French were undoubtedly masters of one part of the field of battle; yet, in other parts, they were so much beaten, that Bonaparte judged it prudent to draw off his forces.

The Russian general, having thus succeeded in the great object of the campaign, which was to weaken Bonaparte as much as possible, and at the same time to draw him farther into the country, resolved to abandon Moscow to its fate; and this he was the more disposed to do, as the French army after the battle had been reinforced by a corps under Marshal Victor. Bonaparte now saw the capital of Russia within his reach: and though, by the persevering refusal of the Emperor Alexander to treat, he could hardly expect that the possession of it would bring him to terms, yet he looked forward to it as a place of refuge against the severity of the Russian winter, and as the probable depository of those articles of provision and refreshment, which his army so much wanted. How great then must have been his mortification and disappointment, when, just as he was entering Moscow, he beheld the flames consuming it! The patriotic governor, and no less patriotic inhabitants, nobly sacrificing their venerated city,—their own homes and property,—rather than that the French should derive any advantage from them.

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Of the hopelessness of the situation of Bonaparte and his army, at this time, it is scarcely possible to form an idea: he had indeed conquered Russia, if that could be called conquest, which consisted in advancing into the interior of a country; after most severe and obstinate fighting, where no provisions were to be had, where all fled from his approach, and in reaching the capital of that country, only to behold it in flames. The winter was approaching,—a Russian winter,—he was at the distance of 500 or 600 miles from a hospitable climate, and from his resources; on all sides of him were an enraged peasantry, and an army accustomed to the climate, acquainted with the country, and constantly increasing; whereas his army could receive no increase; nor even continue at its present force, diminished as it must daily be, by fatigue, want of provisions, and the severity of the climate. In this dreadful crisis, Bonaparte continued his usual and favourite system of deception. His bulletins, calculated to deceive his subjects, represented the climate of Russia as mild, the stores of Moscow as amply sufficient for all the wants of the army, and the peasantry as rejoicing in the presence of their invader. Notwithstanding the approach of winter, he lingered in Moscow, in the vain hope that the Emperor Alexander would agree to peace; but he knew too well that the possessor of the ancient capital of Russia was in fact at his mercy; and he positively refused to negotiate.

At length, the proud and obstinate spirit of Bonaparte gave way, and he resolved to retreat; but even this was represented in his bulletins, as only a lateral movement on Petersburgh. His resolution, however, was formed too late: had he left Moscow, as soon as ever his army was refreshed and prepared for retreat, and before the approach of winter was so near, he might have escaped the unparalleled disasters which befel him; but by delaying it till the middle of October, he rendered it impossible for him to proceed far, before the severity of a Russian winter would attack his troops, while he gave time for the enemy to complete their operations for harassing them. These preparations, indeed, were extensive. On every side the Russians were collected; and especially immense numbers of Cossacks, admirably calculated for this mode of warfare.

Before Bonaparte could leave Moscow, it was necessary to drive back the grand Russian army, which occupied the Kalouga road, by which he meant to proceed: this Murat, who commanded the cavalry, attempted; but he was defeated with dreadful loss. In consequence of this defeat, Bonaparte was compelled to abandon his intention of retreating by the route of Kalouga; but in order to deceive Kutusoff, he began his march in that direction, and afterwards turned off on the road to Smolensk. He himself marched with the van of his army, surrounded by the Imperial guards: the Viceroy of Italy brought up the rear.

The French leave Moscow.

As soon as Kutusoff was informed of the route which the French army had taken, he began his march in a parallel line, leaving it to the other divisions of the army, and especially the Cossacks, to hang on the rear and the flanks of the enemy. No words can paint the misery and sufferings of the French during this retreat. "Scarcely had they, worn out by a day's march, along broken and deep roads, during which they were constantly obliged to be either on the alert, or actually fighting, lain down on the wet and cold ground, to obtain a little rest or sleep, when the Cossacks rushed into their camps, and before the men could prepare themselves for resistance or defence, many were killed—all were thrown into confusion and dismay, and their artillery and stores carried off." While they were thus exposed to the sudden and irregular attacks of the Cossacks, Kutusoff seized every opportunity of bringing them to battle. On the 24th of October, he attacked them most vigorously; the French fought with desperation, but their strength was at length worn out, and they were compelled to retreat with the loss of 16 pieces of cannon. After this defeat, Bonaparte pushed forward before his army towards Smolensko, the Imperial guard alone accompanying him in his rapid and disgraceful flight.

Their disastrous retreat.

The Russian winter sets in.

It is impossible to describe the losses and sufferings of the French till they arrived at this place. About the beginning of November, the Russian winter set in with more than usual severity, and on the first day of the frost nearly 30,000 horses perished. "All possibility of carrying forward their artillery was now at an end: the spirits of the soldiers completely deserted them; they crawled on, exposed to the most dreadful cold, exhausted with fatigue and hunger, emaciated and almost naked. The road was literally blocked up with the dead and the dying; they had no power to defend themselves against the Cossacks, who constantly hovered round them: they had no inclination to do it: death to them would have been a blessing: at the sight of the Cossacks they hoped their miseries would soon be terminated; but their enemies were not so merciful as to put them to death; piercing them with wounds, stripping off the little covering they had, they left them in the snow, there bleeding and naked, to the rigours of a Russian winter. Whenever the French entered any village, where there was the least chance of repose or food, they exerted their little remaining strength, and crawled on their hands and feet to seek it. Frequently, just as they had stretched out their hands to seize a little food, or reached the threshold of a wretched hut, under which they looked for shelter from the weather, perhaps for a few minutes sleep, the remnant of their strength failed them, and they expired."

It may well be conceived, how little able such an army was to resist the regular Russian troops; yet occasionally despair lent them strength, and they fought obstinately, but never successfully. In addition to their miseries, they lost all confidence in Bonaparte, and in fact could no longer be said to compose an army; ignorant of the roads, and afraid to meet with the Cossacks, they wandered in all directions, or actually laid themselves down to die. Every day witnessed the diminution of their numbers, by defeat or the effects of famine and the climate; but their most serious loss took place at Krasnoi, where Kutusoff completely routed them; the division of Davoust, nearly 24,000 strong, being for the most part, killed, wounded, or taken prisoners. A few days afterwards, the division of Ney attacked the Russians, but they were repulsed, and being surrounded, 12,000 laid down their arms. But it is not possible, within our limits, to particularise all the disasters to which they were exposed: The passage of the Beresina, however, must not be omitted; here the slaughter was dreadful, for Bonaparte, after he had crossed it with part of his troops, perceiving that the Russians were close behind him, ordered the bridge to be set on fire, and thus exposed his soldiers to most dreadful destruction, both from the flames and the enemy. After this their retreat to Wilna was not so disastrous: before, however, the troops arrived there, Bonaparte left them, travelling in a sledge *incognito*, along with Caulincourt, and returned to Paris on the 18th of December. Murat was left in command; but he soon followed the example that had been set him; and the command of the disorganized remains of this once most numerous and formidable army devolved on the Viceroy of Italy. The loss of the French in this campaign cannot be estimated lower than 300,000 men; and this loss was entirely occasioned by the mad and obstinate ambition of Bonaparte; for when we recollect that, "at the close of summer, he led an immense army into the very heart of Russia—into a country, in which winter reigns with most intense and unbroken severity for half the year; that in front, and rear, and both sides of this army, were immense bodies of troops, inured to the climate, and cutting off all chance of procuring provisions; and that this army, when compelled to retreat, had to march upwards of 500 miles, without shelter, almost without food and clothing, on roads broken up, or rendered nearly impassable by the snow, exposed to the most intense cold, and harassed night and day by clouds of Cossacks, we may be astonished at the insane rashness of Bonaparte, but we cannot be surprised that nearly the whole of his army was destroyed."

Bonaparte quits his army.

Its immense loss.

That division of the French army which marched on the road to Petersburg, shared the fate of the main army; for, not being able to gain possession of Riga, and being continually opposed by the Russians, while Bonaparte would not allow it to retreat, till he himself had retired, it suffered nearly in an equal degree, both from the enemy, and the severity of the climate.

It has already been stated, that the French bulletins represented Bonaparte's advance into Russia as the conquest of that country, and his possession of Moscow as the completion of his triumph. The real state of the case, however, was known at Paris; and even he, soon after he left Moscow, could no longer conceal it. His twenty-ninth bulletin exposed his disgrace and disasters in more complete nakedness to the citizens of Paris, than they had ever before witnessed. They believed, or hoped, that his situation was even more desperate than he admitted. A report of his death was spread. Part of the national guard betrayed symptoms of open opposition to his government; but the plot, not being laid with judgment and caution, was detected, and the ringleaders apprehended. The intelligence of it is supposed to have contributed to induce Bonaparte to quit the army, and return to Paris.

Plot at Paris.

As the yoke of Bonaparte had been impatiently borne by the Prussians, the defection of a corps of them, which had been attached to the French army that marched on the road to Petersburg, was not surprising. Macdonald, who commanded this army, being thus weakened, and being, moreover, harassed by the Russians, retreated in great disorder; abandoning Koningsberg to its fate, and directing his flight to the Vistula. Across this river the remnant of the French also fled, pursued by their unwearied and implacable enemy.

Defection of part of the Prussians, A. D. 1813.

The king of Prussia, being still in some measure in the power of the French, knew not how to act. His interest, as well as his inclination, led him to justify the defection of his generals, and openly to abandon the French; but he was apprehensive, that if Bonaparte recovered from his losses, he might again be reduced under his power. In these circumstances, on the 15th of February 1813 he made a proposal for a truce, on condition that the Russians should retire behind the Vistula, and the French behind the Elbe, leaving Prussia entirely free from foreign occupation. To this proposal, however, neither party agreed. In the mean time, Bonaparte was deserted by the Austrian auxiliaries, who, indeed, had been of very little service during the campaign.

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The French still continued their retreat; for a short time they appeared as if they would have made a stand at Berlin; but finding the people of Prussia decidedly hostile to them, they quitted that city on the night of March 3d, and the Russians entered it on the following morning, when they were received as friends and deliverers. The French, on leaving Berlin, retreated on the line of the Elbe, towards Magdeburg, where they concentrated their force, and strengthened themselves by draughts from Dresden and Leipsick—the king of Saxony still adhering to their cause. On the 2d of April, the Russians and Prussians first fought together against the French, in the vicinity of Luneburg: the combat was long and sanguinary, but a complete victory was obtained by the allies. The Russians at this time were divided into three armies; one had crossed the Elbe, in order to drive the French towards the Maine; the second was employed in the siege of Dantsic and Thorn; and the third was posted at Custrin and Dresden; the Prussians were distributed in Saxony, Berlin, Hamburgh, and Rostock, and also invested Stettin. The Crown Prince of Sweden, who had long promised his assistance to the allies, was expected at Stralsund, to take the command of 50,000 men. From this account of the extent of country over which the allied armies were spread, may easily be collected the loss of territory which the French had sustained.

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Force of [illegible] Russ[illegible] Pruss[illegible] and [illegible]

Notwithstanding this loss, however, and the still more important loss of his best soldiers, and the blow which had been given to his military reputation, Bonaparte resolved to hazard another campaign; for this purpose he exerted all his activity and vigour in calling forth the resources of France, in order again to place his army on a formidable footing. By a senatus consultum of the 11th of January, 350,000 men were placed at his disposal; and shortly afterwards, in the annual exposé, a very flattering account of the state of the French empire was published, in which its population was rated so high as 42,700,000. At length Bonaparte having appointed the Empress Regent during his absence, set out for the army on the 5th of April, and arrived at Mentz on the 20th. This army consisted of 12 corps, besides the Imperial guards: the different divisions were directed to march in such directions, as to form a junction near Jena and upon the Saale. The

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head quarters of the Russian army, now commanded by Witgenstein, in consequence of the death of Kutusoff, were to the north of Leipsic; the Prussians, under Blucher, were to the south of that city.

Battle of Lutzen.

The first battle was fought in the plain of Lutzen. It was brought on by the Russian general, who wished to prevent the junction of the different divisions of the French army. The Prussians, eager to avenge the wrongs their country had sustained from France, began the contest; and it soon became general along the line. The villages in front were several times taken and retaken, and the action continued with great carnage till seven of the evening of the 2d of May. The allies kept possession of the field; the 3d of May passed without fighting, and on the 4th Bonaparte retreated. But his retreat was not continued far; for the allies, though victorious, had so weakened themselves by their victory, that they could not oppose the advance of the French to the Elbe, which river they crossed at Dresden on the 6th and 7th; and at this place Bonaparte fixed his head quarters. The King of Saxony having now joined the French with his forces, the allies continued to retreat, and took up a position on the heights overhanging the Spree, with the centre of their front line behind Bautzen.

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Here Bonaparte resolved to attack them, with his main army in front, while the divisions of Ney, Lauriston, and Regnier, turned their right. The latter part of this plan was foreseen, and frustrated by the Russian General, who ordered these divisions of the French to be separately attacked; this took place on the 19th. At four in the morning of the 20th, the grand attack by the French main army commenced; and after seven hours hard fighting, they so far prevailed, that the allies were obliged to fall back to Hochkirchen. On the 21st they were again attacked in this position; this battle was still more obstinately contested than the former; but it also ended in the allies again retreating, but in good order, and presenting a formidable front to the French. The track of their retreat was towards Silesia, the capital of which was entered by Lauriston on the 1st of June.

In consequence of the necessity under which the allies were placed of calling in all their separate corps to make up for their losses, or to put them out of danger from the advancing foe, Hamburgh was evacuated by them; and after a short time, and an ineffectual resistance, again occupied by the French.

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Bonaparte had hitherto been successful, and had driven the allies before him; but his successes and his advance had been dearly purchased; he therefore listened to the Emperor of Austria, who offered his mediation. In consequence of it, a cessation of hostilities took place, and it was agreed that a congress should be held at Prague. But this congress produced no pacific result; and the Emperor of Austria, from a mediator, became an enemy to Bonaparte, as soon as he saw that he was not sincerely disposed for peace. The Crown Prince of Sweden also had by this time landed in Germany; so that the enemies of Bonaparte were greatly increased. The immediate vicinity of Dresden was the principal scene of the most important actions, all of which terminating in favour of the allies, their advanced guard encamped on the heights above that city on the 26th of August. On the following day, the French abandoned their ground before Dresden, and withdrew into the suburbs, and their different works, which they had rendered extremely strong. Against them, however, though estimated at 130,000 men, thus defended, the allies resolved to move: but their enterprise was unsuccessful; and on the following day, the 28th of August, the French became the assailants, the allies occupying a very extended position on the heights round the city. In this engagement, General Moreau, who had come over from America to oppose Bonaparte, was mortally wounded. The result of it was, that the allies retreated in the evening, having sustained a very considerable loss. They were pursued by a large division of the French under Generals Vandamme and Bertrand; who were at first successful, but being unexpectedly attacked on all sides by fresh corps of the Austrians and Prussians, Vandamme and 10,000 of his men were taken prisoners.

Death of Moreau.

Success of the Allies.

The allies were also successful in Silesia, the recovery of which from the French was entrusted to Blucher. Having defeated Marshal Macdonald, and taken 18,000 prisoners, on the banks of the Katsbach, on the 2d of September, he encamped near Gorlitz, and in an address to his troops, congratulated them on the deliverance of Silesia from the enemy.

Battle of Juterboch.

On the 6th of this month, the Crown Prince of Sweden having collected the Swedish and Russian armies, was informed that about 70,000 of the French, under the command of Ney, were in full march upon Juterboch, in order to attack a very inferior corps stationed there. He immediately ordered the Prussians under Bulow to support this corps, while he advanced as quickly as possible. The Prussians fought nobly against much superior numbers; and as soon as the columns of the Prince's army began to appear, the French retreated. In this action they lost nearly 18,000 men, and 80 pieces of cannon.

The whole of the allies now approached Dresden in different directions; but Bonaparte, not cured of that obstinacy which had occasioned the ruin of his army at Moscow, persevered in remaining in Dresden till he found that the allies, by directing their principal efforts towards Leipsic, would completely cut him off from France, unless he quitted it. On the 7th of October, therefore, he left Dresden in company with the King of Saxony, and took up a position in the neighbourhood of Leipsic. About this time, he was deserted by the King of Bavaria, who ordered 55,000 of his troops under General Wrede, to act with the Austrians. The allies having collected their respective armies round Leipsic, resolved to attack the French in various points. Several very severe battles took place in consequence of this, in all of which the French were defeated; and at length they were obliged to concentrate their whole force in the immediate suburbs of the town. On the 16th of October, the grand army of the allies made a general attack to the south of it; but after a dreadful slaughter, they could not succeed in dislodging the French. The 17th was chiefly occupied in preparing for a renewal of the contest. On the morning of the 18th, the different armies of the allies advanced from the villages round Leipsic, for their grand attack on the city. During the battle, some Saxon and Westphalian regiments abandoned Bonaparte, and went over to the allies. Few contests are on record, that have been more dreadful or more decisive than the battle of Leipsic; the result of which was, that the French lost, in killed, wounded, and prisoners, 40,000 men, and 65 pieces of artillery: seventeen German battalions also deserted from them and joined the conquerors. On the morning of the 19th, the King of Saxony sent a flag of truce to the Emperor

Battle of Leipsic.

Alexander, requesting him to spare the town; but an immediate assault was ordered, and by eleven o'clock the allies were in possession of it two hours after Bonaparte had made his escape. In it were taken the rear guard of the French, amounting to 30,000, and their sick and wounded, nearly 22,000, besides their magazines, artillery, and stores.

The retreat of the French was marked by the most extreme confusion and disorder; and if we take into account, that it was made at a more favourable season of the year, and through a country better adapted to a retreating army, it cannot be deemed less disastrous or disgraceful than the retreat from Russia. The line of their retreat was on Frankfort: they were followed by the Prussian General D'York, while the combined Austrian and Bavarian army was posted at Hanau to intercept them. Here, on the 29th of October, a partial engagement took place, in which the French were successful. On the 31st, Bonaparte fixed his head quarters at Frankfort; and on the 2d of November he arrived at Mentz, whence he proceeded shortly afterwards to Paris.

Bonaparte arrives in Paris.

His decrees.

On the 14th of November, he replied to the address of the Senate in language of apparent frankness, acknowledging his disasters, but appealing to the French nation for support under them. Two decrees were immediately passed, one imposing additional taxes, and the other ordering a levy of 300,000 conscripts, as the enemy had invaded the frontiers on the side of the Pyrenees and the north, and as those of the Rhine and beyond the Alps were threatened. The natural effect of his reverses now began to appear: a revolution broke out in Holland, which, being assisted by the English, terminated in separating that country from France. Hanover also was entered, and liberated by the Crown Prince of Sweden. Bremen and Embden were recovered. The Viceroy of Italy, unable to cope with the Austrians, abandoned Trieste and the Dalmatian coast; and Dresden and Stettin, with their numerous garrisons, surrendered to the combined forces.

Holland, Hanover, &c. recovered.

Declaration of the Allies,

The allied sovereigns, who had assembled at Frankfort, published a declaration on the 1st of December, laying open their views with regard to France. Against that country they did not make war, but against the insatiable ambition of Bonaparte, to whom they had already offered fair and honourable terms of peace, but in vain. It was for the advantage of Europe, that France should be independent and great. This they did not wish to prevent; so far from it, if they succeeded in their plans, they would leave her so; but they were also determined that their states should, for the future, be also independent,—no longer liable to the tyranny and ambition of Bonaparte. The last twenty years had witnessed unparalleled calamities heaped on Europe: They trusted they had now in their power to put an end to these calamities, and they were resolved to do so. This declaration, so moderate and liberal, displeased Bonaparte. There was nothing in it on which he could lay hold, as manifesting an intention to injure the honour or weaken the just power of France; he therefore replied to it in general and ambiguous terms, in his speech before the Legislative Body on the 19th of December, maintaining, that the allies alone were to blame if peace had not been concluded, as he had adhered to their preliminary basis; adding, however, that if peace were made, it must be on terms consistent with honour.

who invade
nce.

In the month of December, the allies crossed the Rhine and invaded France. This operation was performed with little or no opposition at various points, not a single French army appearing in the field to defend the frontier. The strong fort of Huningen, in Alsace, was invested, and the allied troops spread over that province and Franche Compté. Under these circumstance, Bonaparte issued a decree on the 26th of December, announcing the mission of senators, or councillors of state, into the military divisions, to act as commissioners extraordinary, armed with powers to provide and organize the means of defence; and thus, in fact, suspending all the magistracies, and other authorities in the country, and extending the immediate agency of military despotism to every part. There were thirty commissioners appointed, who were to be attended by as many law officers. These efforts, however, were unavailing, and their result proved at once, that the French people were wearied out with calamity, and were disposed to regard the allies rather as friends than foes, and that the authority and power of Bonaparte were drawing to a close; for he must have expected, either that the people would have risen of their own accord, when called upon to defend their country, or that he possessed the means of compelling their services on this occasion; neither of which took place to any considerable extent.

Bonaparte tries in vain to rouse the French.

Affairs of the Peninsula.

We must now turn to the affairs of the peninsula. In December 1812, the French main army, now under the command of Drouet, was in the neighbourhood of Salamanca and Valladolid, occupying various posts on the line of the Tagus. Joseph Bonaparte was at Madrid, and Soult had his head quarters at Toledo. Thus all the central parts of Spain were in the power of the French. Lord Wellington was at Freynada, on the frontiers of Portugal, about the middle of March; nearly all the French troops were withdrawn from La Mancha, and the army of the south was concentrated between Talavera, Madrid, and Toledo,—Joseph Bonaparte having quitted Madrid. These movements, and others connected with them, indicated that their plan was to retire from the central provinces, and take strong positions in the north and north-east. In the south-east of Spain, Suchet had been obliged to quit Valencia, in consequence of some successes gained by the Anglo-Sicilian army under Sir John Murray. In April, the main French army was still occupied in moving from the Tagus to the Douro; but their force was much weakened, as, during February and March, nearly 25,000 men had been sent into France, to assist Bonaparte in his German campaign.

These movements and indications of the French, determined the plan of Lord Wellington. On the 26th of May, he fixed his head quarters at Salamanca. Here a slight skirmish took place. His army afterwards continued to advance to Toro, the French persevering in their plan of evacuating the central provinces. On the 7th of June, Lord Wellington crossed the Carrion, and soon after reconnoitered a strong position which the French occupied at Burgos. This, however, they did not defend, but retired with their whole force in the night, marching towards the Ebro, on the road to Miranda. On the 14th and 15th Lord Wellington crossed that river, and continued his march towards Vittoria.

Joseph Bonaparte was now the nominal commander of the grand French army; but the actual command was vested in Marshal Jourdan. The army consisted of the whole of the armies of the south and the centre, of four divisions, and all the cavalry of the army of Portugal, and some troops of the army of the north. On

Battle of Vittoria.

the 19th of June, it took up a position in front of Vittoria. On the 20th Lord Wellington's army halted, and his Lordship reconnoitered the French. On the 21st he attacked them, and gained a most signal and glorious victory. The retreat of the French was so rapid, that they were unable to draw off their baggage and artillery, the whole of which fell into the hands of the victors. The French retreated by the high road to their own country, first to Pampeluna, and on the 25th by the road of Roncesvalles into France; a brigade of the army of Gallicia, under General Castanos, driving them across the Bidassoa, the boundary river, over the bridge of Irun.

Marshal Suchet was still in the south-east of Spain, where Sir John Murray was employed in besieging Tarragona. As the relief of this place was of the utmost importance, the Marshal collected about 20,000, and advanced towards it. Sir John Murray, not deeming himself sufficiently strong to meet his opponent, reimbarked with so much precipitation, as to give rise to much complaint and censure of his conduct.

In the mean time, though the main French army had actually evacuated the Peninsula, and entered their own country, part of their troops still maintained themselves in the valley of Bastan; of which, on account of its richness and strong positions, they seemed resolved to keep possession. Against them, therefore, a detachment of the British were sent, who succeeded in dislodging them. It was now supposed, that the French would retire quietly before their conquerors; but Bonaparte, notwithstanding his reverses in the Peninsula and Germany ought to have taught him the necessity of confining himself to one object, still persevered in his resolution to recover Spain, if possible. For this purpose Soult, certainly his best general, and who had greatly distinguished himself in the south of Spain, was appointed, by an imperial decree, commander in chief of the French army in Spain and the southern provinces of France. He joined the troops on the 13th of July, and on the 24th collected at St Jean the right and left wings, amounting in all to 30,000 or 40,000 men; with whom, on the subsequent day, he attacked the British forces that were posted at Roncesvalles: Having turned their position, they were obliged to abandon it. On the same and the following days, to the end of the month, Soult repeated his attacks; while, on the 30th, Lord Wellington became the assailant, and obliged the French to abandon a position, said by his Lordship to be "one of the strongest, and most difficult of access, that he had yet seen occupied by troops." The result of all these operations was, that though the French at first succeeded in driving in part of Lord Wellington's army, yet on the night of the 1st of August it occupied the same positions which it had done on the 25th of July. Soult was now posted behind the Puerto. From this position Lord Wellington resolved to dislodge him, by a combined movement of three advanced divisions. One of these, however, being first formed, commenced the attack by itself, and actually drove the two divisions of the enemy from the heights which they occupied. Thus this part of the Spanish frontier was entirely freed from the presence and occupation of the French.

The strong fortresses of Pampeluna and St Sebastian still held out. The former was besieged by the Spaniards; the latter by Sir Thomas Graham. An unsuccessful attack was made on St Sebastian on the 25th of August, which cost the British many lives. This, however, did not deter Sir Thomas Graham from renewing the attack; but the attempt seemed nearly desperate, when the assailants having made repeated but fruitless exertions to gain an entrance, no man surviving the attempt to mount the narrow ridge of the curtain, he adopted the critical and venturous expedient of ordering the guns to be turned against the curtain, the shot of which passed only a few feet over the heads of the men at the foot of the breach. This manœuvre, joined to the success of the Portuguese in another quarter, decided the fate of St Sebastian. But Soult was too deeply sensible of its importance to permit it to fall, without making an effort to relieve it. He therefore made several desperate attacks on the allied army; but, though several of them were directed against the Spaniards and Portuguese, they repulsed them with great bravery and steadiness; and on the 18th of September the castle of St Sebastian surrendered.

Fall of St Sebastian.

Lord Wellington enters France.

On the 7th of October, Lord Wellington crossed the Bidassoa and entered France; but he did not commence offensive operations till the fall of Pampeluna had disengaged the right of his army from its blockade. Having now all his forces at liberty, he resolved to execute a grand operation against the French. Ever since the beginning of August, they had occupied a position, with their right upon the sea, in front of the town of St Jean de Luz, their centre on a village and the high grounds behind it, and their left on a strong height. This position, naturally advantageous, they had fortified with great skill and care. Lord Wellington soon determined on his plan of attack; but the execution of it he was obliged to defer, in consequence of the heavy rains. On the 10th of November, however, the weather proving favourable, he commenced his attack, the object of which was to force the centre of the enemy, and establish the allied army in the rear of their right. The various attacks to accomplish these objects began at day light, and it was night before the rear of the right of the French army was gained. On the next morning they were pursued across the Nivelle, and on the following night they retired to an entrenched camp in the front of Bayonne. As, however, they still held posts on the rivers Adour and Nive, Lord Wellington caused a series of manœuvres and operations to take place on the 9th, 10th, 11th, 12th, and 13th of December, the result of which was, that the French were driven from most of their positions, and obliged to confine themselves to the vicinity of Bayonne.

Battle of St Jean de Luz.

In the mean time, Suchet, in the south-east of Spain, seemed resolved to maintain himself, notwithstanding the retreat of the French main army from the Peninsula. Sir John Murray having been recalled, Lord William Bentinck had assumed the command of the Anglo-Sicilian army. His first operation was to resume the siege of Tarragona, which Sir John had abandoned on the advance of Suchet. But the Marshal again advancing with nearly 25,000, Lord William Bentinck was obliged to imitate the example of his predecessor, and retreat upon Cambrilly.

Advance of the Allies into France, A. D. 1814.

By the middle of January 1814, part of the allied army occupied Langres, an ancient and considerable town, 100 miles within the French frontier: till they reached it, there was not a single shot fired at them by any body but the military. Bonaparte had not yet quitted Paris, and had not been able to collect any considerable force. The troops he had mustered were under the command of Marshals Victor and Marmont, the former of whom advanced into Alsace, to oppose the Bavarians, under General Wrede; but not being able to cope with them, he abandoned this province, and retired into Lorraine. Here an engagement, the first on French ground, took place: Victor was defeated, and obliged to continue his retreat to Luneville. By the middle of January, the Cossacks, who had entered France in great numbers, gave a clear proof, in what a defenceless state it was, by pushing on between Epinal and Nancy, unsupported by any regular troops.

Congress at Chatillon.

The second French army, under the command of Marmont, was opposed to Blucher, whose troops had crossed the Rhine near Coblentz and Manheim; but he found it necessary to retreat before the Prussian general, and take up a position behind the Saare. Even here he could not long continue; for by the end of January he had fled to Verdun, while Victor was at Commency; and the additional troops which Bonaparte had placed under the command of Mortier and Macdonald, were at Chaumont and Namur. The allies, at this time, occupied Lorraine, as far as the Meuse, all Alsace, Franche Compté, and great part of Burgundy. Such, however, was the embarrassment of Bonaparte, that he had not yet quitted Paris. Notwithstanding the representations of his force, and the favourable disposition of the French, which were given in the French official newspapers, his means to cope with the allies were so inadequate, that he resolved to sue for peace. The allied sovereigns had taken up their head quarters at Chatillon; and thither Caulincourt, Bonaparte's minister, was directed to proceed. But peace was not expected, even by the most sanguine; for though the allies were sincerely disposed towards it, and the Emperor of Austria was suspected of a leaning towards his son-in-law, which retarded his cordial co-operation with them, yet the character of Bonaparte left no doubt, that his sole object was delay, in order to augment his forces; and that, if he were again successful, his conduct would be as ambitious and overbearing as before. A congress, however, was held at Chatillon, which was attended by the allied sovereigns in person, and by Caulincourt on the part of Bonaparte, and Lord Castlereagh on the part of Great Britain.

In consequence of the rapid advance of the allies, the more young and active members of the Bourbon family left England, and embarked for the continent towards the end of January. This step they took entirely of their own accord, since none of the allied powers had given them reason to believe that they would declare or support Louis XVIII. On the contrary, they had solemnly engaged not to interfere in the internal government of France, and were even disposed to treat with Bonaparte. But the Bourbon princes knew their adherents were numerous in different parts of France, and these they wished to increase and animate by their presence and example.

Stoppage of the national bank.

The situation of Bonaparte, already extremely embarrassing, was rendered still more so, by the stoppage of the national bank of France. By the report of the directors, it appeared that their ready money amounted only to £600,000, which, from the eagerness of the holders of notes to obtain payment, would be exhausted in a very few days. In order therefore to prevent the draining of the bank, it was announced, that whatever number of notes might be presented for payment in the course of the day, not more than the value of £20,000 would be paid; and that no one would be paid, unless he were the bearer of a number delivered to him by the mayor of his quarter. This measure was by no means calculated to remedy the evil effectually; and even as far as it was efficacious, it only produced an evil of greater magnitude, by diminishing the public confidence, and proclaiming to the people, that their just demands on the bank were to depend for payment on the certificate of those who were entirely under the controul of Bonaparte.

Bonaparte leaves Paris to join the army.

At length, Bonaparte having appointed Maria Louisa regent, left Paris on the 25th of January. The French armies were retreating from different quarters towards Chalons on the Marne, for the purpose of assembling within the line of the Meuse. The allied armies were concentrating and pressing on the same point. Blucher by the way of Nancy and Toul, and Schwartsenberg, who had the chief command of the Austrian and Russian armies, by Langres and Chaumont. About the beginning of February, these two grand armies came entirely into communication with each other, when two corps of Austrians were placed under the command of Blucher. This general immediately made his dispositions for attacking the French, who rested their right at Dienville, their centre at La Rotherie, and their left near Tremilly. After some partial movements and operations, by which part of the allies got possession of an important position, which Bonaparte in vain attempted to recover, a most desperate engagement took place at La Rotherie. Bonaparte led on his troops in person, and at first was successful; but the allies, fighting under the eye of their sovereigns, and animated by the example of Blucher, who bore a deadly hatred to Bonaparte, opposed them with superior firmness and perseverance. The battle lasted till ten at night, when the Russians remained masters of La Rotherie, though the French held the ground beyond it, and at midnight, on the 1st of February, were in possession of the heights of Brienne, near which their right had been posted at the commencement of the engagement. Bonaparte, fully sensible of the extreme importance of La Rotherie, made many desperate attempts to regain it, but being opposed by Blucher in person, he was in all of them unsuccessful; and at last he was compelled to retreat with a loss of 40 pieces of cannon, and 4000 prisoners. He retreated first to Troyes, and afterwards to Nogent. On the 5th of February, Marshal Macdonald was defeated by D'York, between Vitrey and Chalons.

Battle of La Rotherie.

Indifference of the French.

The allies followed the beaten and retreating foe as rapidly as they could. On the 7th of February, they entered Troyes, where Prince Schwartsenberg fixed his head quarters, Marshal Blucher being about 20 miles to the north of this town. The French people beheld these disasters of their monarch, and the advance and successes of the allies in general, with equal indifference. Notwithstanding Bonaparte painted in the most dreadful colours the cruelties of the Cossacks, and called upon them to rise *en masse* to defend their country from these barbarians, they remained unmoved and quiet. The allies did not invite them, much less require them to rise in favour of the Bourbons; and even in some cases, as they were still negociating with Bonaparte at Chatillon, they rather repressed the loyal expressions of the people, in favour of their legitimate sovereign. As therefore they felt no affection for Bonaparte, and found that the allies performed their promise in neither forcing the Bourbons on them, nor plundering their country, they gladly remained quiet, and, to all appearance, almost indifferent spectators of the great contest that was carrying on in the midst of them.

Bonaparte finding himself unequal to contend with both the allied armies, pursued his usual plan of directing his whole force, first against one singly, in the hope if he succeeded, of overwhelming the other: and as

Desperate attacks of Bonaparte on Blucher.

Blucher had separated himself to a considerable distance from the rest of the allies, Bonaparte resolved to follow him. Before, however, he did this, he made a rapid and unexpected movement to the north of Nogent, where he attacked a Russian corps, and took the whole of them prisoners. On the 14th of February, having joined Marmont, he advanced against Blucher, who being inferior in numbers, and particularly in cavalry, formed his infantry into squares, and retreated. Bonaparte followed him, but notwithstanding his attacks were almost incessant and very desperate, he made little or no impression, not one of the squares being broken. In order to intercept the retreat of Blucher, Bonaparte had ordered a corps of cavalry to push forward and get into his line; but Blucher forced his way throught it, by opening a heavy fire of artillery and musketry. At night he reached Etoges, but here he was assailed by a body of infantry, which had penetrated through bye roads on his flanks and rear; he was therefore again under the necessity of renewing the attack, and was again successful. In the mean time, the entrenched camp, which Bonaparte had formed for the protection of his army of reserve at Soissons, was assailed by General Winsingerode with such impetuosity, that nearly 3000 men were taken, and the town itself was entered.

While Bonaparte was pursuing Blucher, the grand army put itself in motion on the left. On the 11th of February, a division of it carried by assault the town of Sens, 82 miles south-east of Paris, and afterwards joined the Bavarians under General Wrede. Other divisions of the allies advanced nearly in the same direction; so that by the middle of February, they had spread themselves about 40 miles along the course of the Seine. Marshals Victor and Oudinot, to whom the protection of this important river had been entrusted, alarmed at the advance of such superior numbers, abandoned the left bank, and destroyed the bridges; these, however, being soon re-established, Prince Schwartzenberg, the commander in chief of the allies, fixed his head quarters at Bray. The allies, however, had now spread themselves so much, and thereby so weakened their line, that Bonaparte returning quickly from the pursuit of Blucher, gained some advantages over part of the grand army, and in consequence of this the commander in chief united the whole of it behind the Seine. Part of it was posted near a bridge over this river; this Bonaparte repeatedly attacked, but was repulsed three times with great slaughter. As, however, it was of the greatest importance for him to gain this position, he renewed the attack the fourth time, and obtaining possession of the bridge, passed over a considerable part of his army.

Blucher, though he retreated before Bonaparte, no sooner found that his adversary was gone against another part of the allies, than he resolved again to advance; his object evidently being to press on, if possible, to Paris itself. After having prevented Oudinot from crossing the Seine, and obliged Marmont to retreat, even after his junction with Macdonald, he pushed forward in such a manner as to render the allies masters of the whole line of the Marne for above 80 miles. Bonaparte now found himself under the necessity of again turning his principal attention to Blucher; for it is observable, that whenever the French armies in this campaign were commanded by any of his marshals, they were unsuccessful. Bonaparte alone seemed to be able to procure them the chance of success. It was therefore absolutely necessary, that he should march with the utmost rapidity alternately from the grand army of the allies to Blucher, and from Blucher to the grand army. At this time, his object was to prevent the junction of this general with Winzingerode; but being foiled in his project, he could not retreat without a battle. Between the 4th and the 9th of March, various skirmishes took place between his troops and those of Blucher; on the latter day, the Prussian general determined to give battle at Laon; he was, however, anticipated by Bonaparte, who, taking advantage of a thick mist, attacked his right and centre, and obliged him to fall back to the very walls of Laon. As soon, however, as the mist disappeared, Blucher's army regained the ground which it had lost; and a severe contest ensued on their right and centre. The most important part of the engagement, however, took place on the left of Blucher's army, which the French attacked under a heavy cannonade. But Blucher immediately reinforcing his left with two divisions, and ordering his whole army to advance, the French were not only repulsed, but actually borne down, and thrown into very great confusion, retreating towards Rheims. In this engagement Bonaparte lost upwards of 70 pieces of cannon; and the number of prisoners was immense.

Battle of Laon.

The negociations at Chatillon were still going on, the allies, notwithstanding their successes, adhering to their former proposal to treat with Bonaparte as the Emperor of France. When he was unsuccessful, he directed Caulincourt to listen to their terms, but as soon as ever he gained the most trifling advantage, he displayed his characteristic haughtiness, and actually behaved as if the allies were in his power. He seems, even at this time, to have calculated on the lukewarmness of Austria; and it is not unlikely that the negociations were kept open longer than they would otherwise have been, and better terms were offered to him, in consequence of the connection between him and the Emperor of Austria. He might be strengthened, too, in this belief, from the circumstance that the Austrian army hitherto had done very little for the common cause, Blucher not having been supported, as he might, and ought to have been, by Prince Schwartzenberg.

Rupture of the negociation at Chatillon.

At length, however, even the Emperor of Austria was convinced that no peace could be made with Bonaparte; accordingly, on the 18th of March, the final and complete rupture of the negociation took place. Immediately after this event, Bonaparte directed all his efforts in a most desperate manner against Blucher: for two days he poured his battalions against the immoveable army of that general; but finding that he could make no impression, he bent his efforts southwards against the grand army of the allies. On the 21st, the two armies were near, and opposite each other, ready for battle; but Bonaparte, perceiving that he had not the smallest chance of success, moved off his columns on the road to Vitrey. At first he proceeded in a northern direction, but afterwards turned to the east on St Dizier, and thus found himself on the 24th of March exactly where he was on the 26th of January, when he opened the campaign.

Operations in the south of France.

Let us now turn our attention to the movements and operations of Lord Wellington. Though his army was in the south of France, yet from the vicinity of its situation to the foot of the Pyrenees, the weather was so very unfavourable, that he could not advance till the 23d of February. His first movement was across the Adour and two other rivers: These were successful; and by the 27th of February, the whole army had taken up a and immediately presented to the Senate; it was read twice, and a commission appointed to examine it. On the evening of the 5th of April, the commission made its report, and the constitution was adopted unanimously. By it, Louis was to be chosen sovereign, according to a charter, of which the following are the most important articles: The French call to the throne Louis, the brother of the last king. The executive power belongs to the king. There are to be 150 senators at least, and not more than 200, named by the king; their dignity hereditary; and revenues allotted to them. The princes of the blood and of the royal family are members of the senate. The legislative body remains as before; it shall not sit for more than five years: The king may convoke, adjourn, and dissolve it; but in this last case, he must call another legislative body in three months at the latest. The king, the senate, and the legislative body concur in the making of the laws; but those relating to contributions can be proposed only in the legislative body. The sanction of the king is necessary for the completion of a law. The legislative body has the right of discussion: their sittings are open. No member of the senate or legislative body can be arrested, without a previous authority from the body to which he belongs. The ministers may be members either of the senate or legislative body. Equality of proportion in the taxes is a matter of right: no tax can be imposed or received, unless it has been previously consented to by the legislative body and the senate. The law shall fix the amount and the recruiting of the army. The independence of the judges is guaranteed; they are to be for life, and irremovable. The institution of juries is preserved. The king has the right of pardon. The person of the king is sacred and inviolable; but all his acts must be signed by a minister, who are responsible for them. The freedom of worship and conscience is guaranteed. The liberty of the press is entire, with the exception of the legal repression of offences resulting from the abuse of that liberty. The public debt is guaranteed; the sales of the national domains are irrecoverably maintained. No Frenchman can be prosecuted for opinions or votes he may have given. The right of individuals to petition every constituted authority is recognised. The present constitution shall be submitted to the acceptance of the French people. Louis Stanislaus Xavier shall be proclaimed king of the French, as soon as he shall have signed and sworn by an act stating, "I accept the constitution. I swear to observe it, and cause it to be observed." This oath shall be repeated, when he shall receive the oath of the fidelity of the French nation.

Louis XVIII. chosen sovereign, and a constitution framed.

At this time Louis was so infirm in his health, that he was not able to leave England immediately; but his brother was appointed Lieutenant-General of France, and repaired to Paris, where he was received with great enthusiasm. He declared his readiness to adhere to the constitution in the name of his brother, although he acknowledged he was not authorised to that effect. As soon as Louis was sufficiently strong, he left England, and on the 3d of May made his solemn entry into Paris. "When he came to the palace of his fathers, a vast crowd collected in the garden, appeared, by their lively acclamations, to solicit the presence of his majesty. The King presented himself in compliance with the wishes of his people. The Duchess D'Angouleme was at his right hand, and the Duke de Berri at his left. Shortly afterwards, the daughter of Louis XVI. made way for Monsieur. The King instantly embraced his bro- [illegible] acclamations were redoubled. The enthusiasm was at its height, when the King, raising his arms towards the crowd, seemed to say, "You are my children, I speak to you from my heart, I embrace you thus." The people understood him, by crying out, "Long live the King, long live our father."

On the 30th of May, the definitive treaty of peace was signed at Paris, of which the following are the principal articles: The limits as they existed January 1st 1792, are restored to France. Holland was to receive an accession of territory; but this, as well as the regulation of Germany and Italy, was to be the subject of the deliberations of a Congress to be held at Vienna. All the colonies, fisheries, factories, &c. which she possessed in 1792, except St Lucie, Tobago, and the Isle of France, are restored. She is to erect no fortresses in the East Indies. Two-thirds of the shipping in the harbours of Antwerp and Flushing are to be given up to her. The last article provides for a Congress to be held at Vienna by the Plenipotentiaries of all the powers of Europe, to regulate the arrangements requisite to carry this treaty into full effect.

Definitive treaty of peace.

Before Marshal Marmont agreed to give up Paris, he stipulated with the allies for the personal safety of Bonaparte, and that a provision should be made for his future support. On the night of the 4th of April, a proposal was brought to the allies from Bonaparte, that he would abdicate in favour of his son; but as he was already deposed by the provisional government, no attention was paid to it. He then renounced the sovereignty in the following terms: "The allied powers having proclaimed that the Emperor Napoleon is the only obstacle to the re-establishment of the peace of Europe, the Emperor Napoleon, faithful to his oath, declares, that he renounces for himself and his heirs, the thrones of France and Italy; and that there is no personal sacrifice, even that of life, which he is not ready to make to the interest of France." Afterwards a formal treaty was concluded at Fontainebleau between him and the allied powers, by which the titles of Bonaparte and of all his family are guaranteed to them during their lives;—the island of Elba is appointed his residence, of which he is to hold the full sovereignty, with an annual revenue of two millions of francs, in rent charge in the great book of France. By the fourth article, the duchies of Parma, Placentia, and Guastella, were granted in full sovereignty to the Empress, to pass to her son and his descendants in a right line. By the sixth article, a rent charge of 2,500,000 francs was decreed to the branches of Bonaparte's family; and by the seventeenth article, he was allowed to take with him to the isle of Elba 400 men, and to retain them there as his guard. To all of this treaty the British court refused its sanction, except so far as regarded the arrangements for securing the Italian duchies to Maria Louisa, and the isle of Elba to Bonaparte. To this island he was conveyed with as little delay as possible. During his journey, especially in the south of France, he was frequently in danger of his life, from the violent hatred which the mob expressed against him.

Bonaparte renounces the sovereignty.

Treaty with him.

Departs for Elba.

Before we proceed to the narrative of events that render even the extraordinary transactions which the Revolution had hitherto given rise to, comparatively tame and common place, we shall offer some remarks, First, on the causes which produced the liberation of the continent of Europe from the dominion of the French, and also the overthrow of Bonaparte; and, Secondly, on the condition and character of the French people at the time when Louis XVIII. ascended the throne.

Contrast between France in 1812 and 1814.

In the spring of 1812, nearly the whole of the continent of Europe was subservient to the will, and conducive to the interests of Bonaparte. In the Peninsula, indeed, he had not been equally successful; but, at this period, it seemed as if it were only necessary for him to pour into it all his force, in order to reduce it to reluctant and restless submission, and to compel the English to retire to their lines in the vicinity of Lisbon. From the Emperor of Austria, after the humiliation to which he had submitted in the marriage of his daughter to Bonaparte, though no cordial and zealous co-operation could be hoped, no formidable or dangerous enmity was to be feared. The king of Prussia was still more humbled in spirit, and reduced in power. The Emperor of Russia, by the treaty of Tilsit, had delivered himself up, contrary to the interests of his kingdom, to the anticommercial schemes of Bonaparte; and though, at this period, he was beginning to struggle to regain his liberty, yet the probable commencement of a new war, seemed to open up only new prospects of triumph and success to his opponent. For never at any former period was the army of Bonaparte so numerous, or so well appointed in every respect. As soon as he had determined to commence hostilities against Russia, nearly half a million of men were put in motion: Frenchmen, Dutch, Germans, Italians, Poles, and even Spaniards, marched under his banner: Of these dissimilar materials he was the animating spirit; and from the success which had hitherto attended his arms, there was great reason to dread that the empire of Russia would henceforth be obliged to contribute the reluctant service of her sons to the conqueror.

In the spring of 1814, in the short space of two years, Bonaparte was compelled to abdicate the throne of France, and to confine himself to a paltry island in the Mediterranean: his armies, beaten, dispersed, captive, or destroyed, were no longer capable of supporting or protecting him; and France, which for upwards of 20 years had poured her plunderers over the continent of Europe, became the seat of a war, in which she was degraded, conquered,—her capital at the mercy of the conquerors, and indebted for her independence, and her ancient and legitimate territory, entirely to the moderation of those conquerors.

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It is not possible to imagine any topic, calculated more deeply to interest the mind, than the contrast which these events afford: Were the intervening period not specified, we should be apt to conclude, that such an essential and wonderful change of affairs, could not have been wrought out, but after the lapse of many years. The causes which produced this unparalleled change, in such a very short period of time, are naturally sought for; and, fortunately for the gratification of curiosity, as well as for the more important purposes of history, considered as philosophy teaching by example, these causes are not difficult to be explained.

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An observation of the Marquis of Wellesley, in the House of Lords, respecting the character of Bonaparte, will open up to us the most important of these causes. Bonaparte was a man, he observed, who would create unto himself great reverses. In him existed not merely that restless and insatiable ambition, which he possessed in common with most conquerors; but an obstinacy so blind and overpowering, as to convert even his great military talents into the causes of his ruin. It is scarcely possible to conceive any chain of events, spread even over a period of many years, which could have blasted the power of the conqueror of Europe so utterly and hopelessly, as his own fool-hardiness and obstinacy did in the short space of a few months, during his campaign of Russia. When we say utterly and hopelessly, we mean in reference to his character; for, could experience have taught him wisdom and moderation, not even his losses in Russia could have driven him from the throne of France. But in the campaign of 1813, he again created unto himself great reverses; sanguine, ambitious, and domineering, when partial and temporary success attended his arms; faithless and unprincipled during the negociations into which the allies entered with him, and obstinate when he met with defeat. By advancing to Moscow at the commencement of a Russian winter, and continuing in that city so long, he destroyed nearly the whole of his army. By obstinately clinging to Dresden, till the allies had actually cut him off from France, he brought on the battle of Leipsic, which completed the destruction of a second army. The same scenes were repeated during the short campaign of 1814, when his means were fewer, his opponents more numerous, and his ruin nearer at hand: still he might have been saved,—the allies would have left him on the throne of France: to their terms he listened when unsuccessful; but no sooner had he gained even a doubtful and hard bought victory, but he most foolishly and fatally for himself, but most fortunately for Europe, allowed his ambitious faithlessness to become so apparent, that the allies were convinced that his dethronement was absolutely necessary to the repose and independence of Europe.

But though Bonaparte was the principal cause of his own destruction, yet there were other causes co-operating, which would indeed have been ineffectual of themselves, but which, aided by the man against whom they were directed, became formidable and successful.

The sounder policy of the allies.

At the commencement of the French Revolution, the sovereigns of Europe, for a short time, united against it; but narrow and blind self-interest; mutual jealousy and apprehension; and an imperfect knowledge of the evils with which it was fraught, dissolved the confederacy. Afterwards they were stimulated or goaded by England to an unwilling and unequal contest. At length fatal and dearly bought experience convinced them, that the only means of preserving even the name of independence, and the remnant of power that France had left them, was by cordially and zealously uniting against her. This union, however, could not have been effected during the plenitude of Bonaparte's power; but after that power was reduced by the obstinacy of the possessor, their union became essentially conducive to the restoration of European independence.

The hatred excited by the tyranny of the French.

At the commencement of the French Revolution, the sovereigns of Europe regarded their subjects with a suspicious and apprehensive eye, as much more likely to assist than to repel the French; and instead of endeavouring to bring them over to form a common cause with themselves, still farther irritated and alienated them by their conduct. Besides, the people were too eager to receive the soldiers of a nation, which had solemnly declared, that they made war only on the palace, but brought peace and liberty to the cottage. A very short experience convinced the sovereigns, that their surest defence against France was in the confidence and loyalty of their people; while the people fatally experienced, that, by being liberated from the dominion of their native princes, and placed under the government of France, they only exchanged one tyranny for another,—a tyranny to which they had been long accustomed, and which was relieved by many acts of protection and kindness, for one which was novel,—which broke in upon those comforts that the former tyranny had left them, and which, as being inflicted by strangers, and

Battle of Orthes.

position within four miles of the French forces under Soult, which were posted in front of the town of Orthes. Although the position of the French general was very strong, his centre being thrown back, and both his flanks advanced on very commanding heights, Lord Wellington resolved to attack him. His plan was, that Marshal Beresford should turn the right of Soult's army, while the third and sixth divisions attacked his left and centre; but the fourth division, to which the attack on the right was entrusted, meeting with great opposition, and being unable to possess itself of the heights, on which the enemy was placed, Lord Wellington changed his plan, and turned the third and sixth divisions against the right of the French; and thus forced him to abandon the heights, lest he should be completely surrounded. We have been thus more than usually particular in describing the manœuvres of the British during the battle of Orthes, as they afford a striking proof of the characteristic promptitude and decision of Lord Wellington's mind. While these operations were going on in this part, Soult found his centre attacked and his left threatened, by the British division of Sir Rowland Hill having carried a position on which it appuyed: Here, however, the French having a numerous artillery, made a vigorous and formidable resistance, but the two points of the base line of his position, (for it was in the form of a triangle,) being hard pressed by flank-attacks, and the centre at the same time yielding to the British, he gave orders for a retreat. At first his troops retreated without confusion; but soon disorder spread among them, and they dispersed and made the best of their way, in the same manner as they had done in the battle of Vittoria. In the night they retired across the Adour, the British being so much exhausted that they could not pursue them to any considerable distance that night. On the 24th, however, they continued the pursuit to St Sevre, where General Beresford having crossed the Adour, advanced to the chief town in the department of the Landes. At first Soult retreated in the direction of Bourdeaux, but being defeated by Sir Rowland in an attempt to defend his magazines at Aire on the Adour, he changed his route, and retreated in the direction of Toulouse. The main British army followed him, while Sir John Hope began the siege of Bayonne. Such was the battle of Orthes,—certainly one of the most general and hard fought in which Lord Wellington had been engaged since the commencement of the Peninsular war; and it may be added, that not only in the positions which Soult fixed on, but in his conduct during the engagement, he fully made out his claim to talents and perseverance as a military man.

Bourdeaux declares for the Bourbons.

The people of the south of France, notwithstanding all the efforts to represent the English as even worse than the Cossacks, received Lord Wellington and his army as friends; treating them with the utmost configence and kindness, and evidently shewing that they dreaded more from their own soldiers than from them. But though they openly expressed their wish to receive back the Bourbons, Lord Wellington could not proclaim or support their cause, as the negociations for peace with Bonaparte were still going on. As soon, however, as the city of Bourdeaux, which had suffered dreadfully from the revolution, and especially from the measures of Bonaparte against commerce, and in which there were many merchants descended from British families, learned that Lord Wellington had entered France, that Soult was entirely defeated, and that his retreat was towards Toulouse, it determined to declare for the Bourbons. A proclamation to this effect was issued by the mayor; deputies were sent to Louis XVIII. and the British were implored to enter the town, and protect it against the forces of Bonaparte. Lord Wellington accordingly gave directions for part of his army to march thither; and the Duke of Angouleme, who had been for some time with him, though not acknowledged or received publicly, hastened to shew himself to the citizens of Bourdeaux. The reception both of the British and of the Duke was most flattering, not only in the town, but in the country through which they passed.

Battle of Toulouse.

In order to bring the affairs of this part of France to a conclusion, we shall proceed with our narrative of them, premising that about this time Bonaparte had been forced to abandon the government of France, and Louis XVIII. had been acknowledged king. Intelligence of these events had been immediately transmitted to Lord Wellington and Soult, but it unfortunately did not arrive in sufficient time to prevent another battle. Soult had taken up a strong position near Toulouse; on the 8th of April, part of Lord Wellington's army moved across the Garonne; between this river and the canal of Languedoc were the fortified heights, that formed the chief strength of the French position: his Lordship resolved at once to storm these in front, and to turn the right of the enemy, while a *tete du pont*, which they formed on the canal to protect their left, should be threatened. The 9th of April was spent in preparing for these attacks; and on the 10th they were carried into execution. They were in all points so well planned, and so admirably executed, that at the close of the day, the French were completely hemmed in, the allies having established themselves on three sides of Toulouse, and the road to Carcassone being the only one left open. In the night of the 11th, Soult drew off his troops by this road; and Lord Wellington entered Toulouse in triumph the following morning. The close of the campaign in the south of France was marked by one unfortunate event: Before Bayonne, which Sir John Hope invested, the French had a fortified camp, from which they made a sortie at three o'clock of the morning of the 13th of April. The piquets of the British army were driven in, and Sir John Hope, in his gallant attempts to support them, came unexpectedly on part of the French: his horse, which was shot dead, fell upon him; and in this situation he was made prisoner.

Although the allies in the north and east of France had at different times, since the commencement of the campaign, reached within a short distance of Paris, yet they had always been obliged to fall back, in consequence partly of a want of concert, and partly of the wonderful rapidity of Bonaparte's movements, who, with a force decidedly inferior, contrived to pass from one point to another, so quickly and unexpectedly, as sometimes to defeat, and almost always to retard the plans of the allies. As soon, however, as Austria began to act in a more decided manner, he was rendered sensible that his fate could not be much longer protracted, unless he had recourse to some desperate expedient, and that expedient completely succeeded. On the 23d of March, the army of Prince Schwartzenberg directed its route to Vitry, which was in possession of the Prussians. Bonaparte also marched on the same place, for the purpose of uniting with Ney and Macdonald, who were advancing from St Dizier; but the Austrians having reached the place before the French, he threw himself into their rear, while he formed a communication with the army of Blucher. Perhaps at the time Bonaparte found himself obliged to adopt this measure; perhaps it was the deliberate consequence of a concerted plan; for, whoever has studied his campaigns, must know that he often obtained success, by doing those acts, which, by their very boldness and rashness, so astonished and perplexed his opponents, that, from the effects which they produced on them in this respect, their success in a great measure originated. In this case, the object of Bonaparte, if his measure was preconcerted, which most probably it was, was to get into the rear of the allies; and threaten their communication with Germany. It may be urged that his force was not adequate to destroy the communication; but it must be recollected, that he could receive reinforcements from the garrisons of the towns on the frontiers, provided nothing occurred to prevent his reaching them. It is not likely, however, that he would have abandoned Paris to its fate by thus getting into the rear of the allies, and leaving the road to the capital open to them, had he not believed that the measures taken for its safety were perfectly adequate; for he must have known, that whoever possessed Paris possessed France, so much influence does the capital possess over the provinces. The defence of this city had been entrusted to Marmont, under whose command the national guards, and such other troops as could be spared for this object, were placed. The allies, disregarding the position of Bonaparte in their rear, resolved to strike a grand and decisive blow, by advancing in a body to Paris. There can be no doubt, that in it they had a strong party; even some of Bonaparte's favourites and former advisers, perceiving that their lives and all they had gained in his service were put in extreme jeopardy, by his rashness, resolved to abandon him and court the favour of the allies. The mass of the population too, were at least indifferent about him; they did not, therefore, regard the approach or probable entry of the allies as any evil or disgrace, and consequently resolved not to oppose it, especially as their opposition would have been fruitless. The army of the allies, which advanced against the capital of France, amounted to upwards of 200,000 men. On the night of the 24th, three divisions of the French arrived at Vitry, in the hope of joining Bonaparte there; but they were immediately attacked by the allies, and driven back. This is only one proof among many others, of the imperfect intelligence which the French possessed, even in their own country; and indicated, perhaps, as much as any other circumstance, the decline, not only of the authority, but of the popularity of Bonaparte. In consequence of similar want of intelligence, both respecting the situation of Bonaparte, and the advance of the allies, a convoy, consisting of 5000 men, who were protecting a large quantity of provisions and other necessaries of the utmost importance to Bonaparte, were met by the allies, and after a gallant resistance, compelled to surrender.

Who advances to Paris.

By this time Bonaparte had reached St Dizier, but there learning that the allies, unintimidated by his throwing himself into their rear, were still pushing on for Paris, and being moreover ill provided with many necessaries for his army, he resolved to hasten back to the capital as quickly as possible. In this march he was closely followed and constantly harassed by Winzingerode with 10,000 horse and 40 pieces of cannon. On the 28th and 29th of March, the allies crossed the Marne near Meaux. On the night of the 29th, Mortier entered Paris, where he found about 8000 regulars and 30,000 national guards, under the nominal command of Joseph Bonaparte. This force took up a strong position near the city, with their right on Belleville, and their left on Neuilly. As soon as the allies approached Paris, a flag of truce, with a proclamation, stating that the object of their march was to protect and benefit, not to injure France, and that they hoped to meet with the good wishes and concurrence of every Frenchman in their endeavours to destroy a government, which had occasioned so many evils, not only to the rest of Europe, but to France itself; they did not come to revenge their own wrongs on Frenchmen, nor to imitate the conduct of Bonaparte in every country which he had invaded; they hoped, therefore, that the people of Paris would follow the example of the citizens of Bourdeaux and Lyons, both of which had deserted the cause of a man who had been the curse of France. The flag of truce, however, was refused admittance, and it was therefore resolved to attack the enemy on the heights above Paris. In the centre of the position of the French army on these heights, there were several redoubts, and on the whole line, 150 pieces of cannon. It was planned that the grand army should attack the heights at Belleville, while the Silesian army directed its attack against Montmartre. Marshal Blucher made his own dispositions for the attack.

After an obstinate resistance, the heights of Belleville were carried; and 43 pieces of cannon and a great number of prisoners were taken. Nearly at the same time, Marshal Blucher commenced an attack on Montmartre, from which the French were also driven with the loss of 20 pieces of cannon. Marshal Marmont, seeing no chance of saving the capital, now sent out a flag of truce, proposing an armistice for two hours, and intimating a desire to receive the propositions of the allies, at the same time agreeing to abandon all the positions which he retained without the barriers. To this proposal Prince Schwartzenberg agreed; and the next day, the allies entered Paris, amidst the acclamations of the populace, by whom they were received as protectors and liberators.

Battle of Montmartre.

The Allies enter Paris.

Before these events took place, Bonaparte, who had arrived at Fontainebleau, sent Caulincourt to the Emperor of Russia; but the Emperor absolutely declined receiving a message from him. On the 2d of April, the French Senate, which had been assembled on the day before, at the desire of the Emperor Alexander, by Talleyrand, in his character of Vice Grand Elector, passed a decree deposing Bonaparte, and absolving all persons from their oath of allegiance to him as their sovereign. The command of the national guard was entrusted to a French general; but General Sacken was appointed to the military command of the city. A provisional government was established, consisting of Talleyrand, Montesquieu, Jaucourt, Bournonville, and the Duke of Dalberg. As soon as this provisional government was formed, they published an address to the army, telling them that they were no longer the soldiers of Napoleon.

Bonaparte deposed.

The Emperor Alexander, on his entry into Paris, had issued a proclamation in the name of himself and his allies, promising that the conditions of peace, which they were willing to grant to France, should be now much more favourable than they would have been if the people of Paris had adhered to Bonaparte; and that the limits of France, as it existed previously to the Revolution, should be scrupulously preserved. This proclamation concluded with calling upon the provisional government to prepare a constitution, which would suit the French people. A constitution was soon framed, and Belgians: Those under Blucher, of Prussians and Saxons; but, in consequence of the mutinous spirit of the latter, most of them were sent back into Germany.

The preparations of Bonaparte were by no means commensurate to those of the allies, nor indeed to the means which France afforded; for it appears by the exposé, that, on the 1st of May 1814, the land forces of France amounted to more than 520,000 men of all descriptions, besides 122,597 on half pay, and 160,000 prisoners. By the treaty of Paris, all the prisoners were to be restored; and, before the return of Bonaparte, they all had returned to France, except a few from Russia. Hence it would appear, that there must have been at least half a million of soldiers in France. How it happened that Bonaparte could avail himself of the services of so few of these, does not clearly appear. It is probable, however, that the exhausted state of France could not bear the equipment and support of a large army; and it is certain, that the republican party were very unwilling to place a numerous army under his controul. To this party, he found himself obliged more and more to succumb. When he first reached Paris, his ministers were Gaudin, Maret, Fouche, Davoust, Savary, and Bertrand. Anxious to confirm the idea that he had abandoned his love of conquest, and his despotic habits, Carnot was taken into the ministry, and Lucien Bonaparte was persuaded to leave Italy and come to Paris. But all these pledges of a reformed character,—his repeated declaration, that he would not commence hostilities,—and even the new constitution, and the assembly of the Champ de Mai, failed to stop the progress of the royalists, or to rouse the mass of the people in his behalf.

Bonaparte's inadequate forces.

Assembly of the Champ de Mai.

The manner in which the members of the assembly of the Champ de Mai were chosen, the character of those members, and their number, cannot accurately be ascertained: From the known policy and practice of the French government at all times, as well as from the peculiar necessity which at this period existed, of imposing upon the French nation and the allies, by the appearance of a zealous devotion to Bonaparte, there can be little doubt, that the Assembly of the Champ de Mai was in a great measure got up (to use a technical but expressive phrase) for effect. At the same time, it must be acknowledged, that in many parts of France very liberal, or perhaps licentious, notions respecting liberty again began to prevail; and that from these parts, it is probable, deputies, freely chosen, and anxious to discharge their duty, were sent.

On the 7th of June, a few days after the assembly of the Champ de Mai, Bonaparte went in state to the palace of representatives, to open the session of the chambers. The oath of fidelity to the Emperor and the constitution having been taken, he uncovered himself for a moment—afterwards covered himself—and then addressed them in a speech, of which the most important topics were, the free constitution which France had just received,—the formidable coalition against the independence of the country,—the actual commencement of hostilities, in the capture of a French frigate by an English man of war,—and the assemblages that had been formed, and the communications which were carried on, with Louis at Ghent, in the same manner as with the emigrants at Coblentz in 1792. He concluded, by alluding to the probability, that the first duty of princes might soon call him to fight for the country; that the army and himself would discharge their duty, while he trusted that the peers and representatives would give to the nation an example of confidence, energy, and patriotism, and, like the Roman senate, swear to die rather than survive the dishonour of France. On the following day, in the House of Representatives, bold and unequivocal proofs were afforded, that Bonaparte was not now nearly so despotic, or so much feared, as before his abdication; and that even the military were regarded with more jealousy, and as subservient to the good of the state. For, on one of the members proposing, that as the title of Louis *le desiré* had been given to Louis XVIII. that of *Sauveur de la Patrie* should be given to Napoleon, he was three times interrupted by calls for the order of the day, and the president at last informed him that he ought to obey them; and on another member moving, that the army had deserved well of the country, the motion was thrown out, on the express ground, that, till the soldiers had benefited the country, they ought not to receive its thanks and gratitude.

Bold proceedings of the chambers.

Probable causes of his delay in quitting Paris.

Bonaparte still lingered in the capital, notwithstanding war was actually commenced, and it seemed his policy to attack the English and Prussians, before the rest of the allies joined them, or invaded France in other quarters. The cause of his delay is not known; but it probably arose from the unsettled state of the interior of the kingdom, from his apprehensions respecting the republicans in Paris, and from the inadequacy of his means effectually to oppose the allies. That his troops would fight with most desperate courage, he might confidently anticipate; but there were other circumstances, besides their inferiority in numbers, which might damp his hopes: many of those Marshals, who had assisted or participated in his victories, were either along with Louis, or were too coldly and equivocally of his party to be trusted. Among the former were Berthier,—his most intimate and longest tried friend and companion, and Marmont;—among the latter were M'Donald. Ney, who might seem to have deserved his confidence, by his most profligate treachery to Louis, was not with the army collected on the northern frontier to oppose the Prussians and English; nor had he hitherto received any intimation that he was to be employed: and even Soult had no distinguished command assigned him. The force which Bonaparte had collected for the defence of the immense frontier of France does not appear to have exceeded 250,000 men; besides the troops in the garrisons, most of which were national guards;—of this force about 130,000 men were in the Netherlands; and the remainder were principally under Rapp near Strasburg, and under Suchet, on the borders of Switzerland and Italy. Of the allies, none were yet come up, except the English, Germans, Dutch, and Belgians under the Duke of Wellington, who might amount to 80,000 men; and the Prussians under Blucher, who probably exceeded 100,000: the former occupied the frontier from the sea to Brussels; the latter from Brussels eastward. Next to them the Bavarians and Russians were to take their position, while the Austrians, a large portion of whom were engaged at present in hostilities against Murat in Italy, and the troops of the King of Sardinia, &c. were to invade France on the south-eastern frontier. Louis had been invited to join the confederacy with what troops he might have with him, but though a great number of officers left France and joined him at Ghent, scarcely any of the French soldiers flocked to his standard.

His force in the Netherlands.

He quits Paris, and arrives at the army June 14.

On Sunday the 11th of June, Bonaparte received addresses from the two Chambers in reply to his opening speech; and on the next day, at four in the morning, he left Paris, having nominated Generals Sebastiani, Grenier, Beaumont, &c. to the command of the capital, which had been rendered as strong as its position and nature would allow. On the 14th, he arrived at Avesnes, where he issued an order of the day, reminding his troops that the 14th was the anniversary of the battles of Marengo and Friedland, and that "to every Frenchman who had a heart, the moment was arrived to conquer or perish." The position of his army was as follows: The Imperial head quarters at Beaumont; the 1st corps commanded by General D'Erlon, at Solfre on the Sambre; the 2d corps commanded by General Reille, was at Ham-sur-Heure; the 3d corps commanded by General Vandamme, was on the right of Beaumont; and the 4th corps commanded by General Girard, was at Philippeville. The Prussian posts were established on the Sambre; these he attacked at day light on the morning of the 15th, and in the course of the day drove them from the river, and made himself master of the ground from Thuin to Fleurus, a distance of about 16 miles, on the Namur road; whilst on the Brussels road, he forced back a Belgian brigade to Quatre Bras, about 12 miles from the Sambre. Bonaparte in this affair evidently had the advantage, and seems to have surprised the allies.

Drives back the Prussians, June 15.

Battle of Ligny, June 16.

On the 16th, the Prussian army was posted on the heights between Bril, and Sombref, occupying the villages of St Amand and Ligny, situated in its front. It consisted of only three corps; the 4th corps was not yet come up. Against these Bonaparte advanced in person with the 1st, 3d, and 4th corps about three o'clock in the afternoon; while Ney, whom he had at length called to the army, was ordered to put himself at the head of the 2d corps, and attack General Picton's division, the corps of the Duke of Brunswick, and the Nassau contingent, which the Duke of Wellington had dispatched in support of the Prussians, and which had reached Quatre Bras about half past two o'clock.

The first object of Bonaparte was to gain possession of St Amand; and he succeeded after a vigorous resistance. He next advanced against Ligny, where the combat was of a most desperate and sanguinary description. The Prussians, with their gallant commander, were urged on to use their most strenuous efforts, by every feeling of a national or individual nature, which can goad men to bravery and vengeance; for five hours the battle raged near this village with doubtful success, while the Prussians by retaking a part of the village of St Amand, regained an advantageous position on a height near that village. Still, however, the French were gradually overpowering the Prussians by their superiority of numbers; anxiously did Blucher look for the arrival of the 4th corps, or the support of the English, but the former did not come up, and the latter with difficulty maintained their position at Quatre Bras. Bonaparte perceiving the advantage which he had gained, and the extreme importance of pushing it to its utmost extent, as soon as the darkness of the night favoured him, ordered a division of the infantry to make a circuit round the village: they accomplished this unobserved; while, at the same time, some regiments of cuirassiers forcing a passage on the other side, the main body of the Prussian army was taken in the rear; at the same moment, the French cavalry succeeded in repulsing several attacks of the Prussian cavalry: this completed the success of Bonaparte: the Prussians were compelled to retreat first to Sombref; and as the 4th corps was not yet come up, afterwards to Wavre.

The attack made by Ney on the English at Quatre Bras was equally desperate in its nature, but not so successful to the French in its result; for all their charges were repulsed in the steadiest manner. In this affair the Duke of Brunswick was slain.

In consequence of the retreat of the Prussians, the Duke of Wellington retired on Waterloo. The position which he occupied was good, but towards the centre it had various weak points. It ran from the Brussels road to the right about a mile and a half in length; and then turned very sharply to the right, and crossed the road from Nivelle to Namur: these two roads cross each other, so that the British position formed nearly a quarter circle. At the turn of the bottom of a slope, was a farm and orchards, called Mount St John, which was the key of the position, and the front of the centre. On their left, the British communicated with the Prussians at Wavre, through Ohaim.

Battle of Waterloo, June 18.

At half past 10 o'clock in the forenoon of the 18th, Bonaparte began to put his troops in motion; and, about an hour afterwards, one of his corps attacked the country-house on the right of the British, where the Nassau troops were posted: these were obliged to give way; but the house itself was so well defended, that the French could not gain possession of it. This attack on the right of the British centre, Bonaparte accompanied with a dreadful fire of artillery; under the cover of which, he made repeated attacks of cavalry and infantry, sometimes mixed, and sometimes separate, from the centre to the right: but the skill of the Duke of Wellington, and the admirable moral courage and physical strength of his troops, were unconquerable. Against one of these attacks of the French cavalry, General Picton, who was with his division on the road from Brussels to Charleroi, advanced with the bayonet. The French, struck with astonishment at the circumstance of infantry advancing to the charge of cavalry, fired, and then fled. At this moment, General Picton was unfortunately killed. The English life-guards next advanced against the 49th and 105th regiments of French infantry: to their support the cuirassiers came up: the most sanguinary cavalry fight perhaps ever witnessed, was the consequence; but the British were victorious, and the cuirassiers were annihilated.

The battle had now lasted upwards of five hours; during which Bonaparte had lost an immense number of men, by his desperate charges, without being able to make any decisive impression. The Duke of Wellington, with the skill of a consummate general, kept his troops entirely on the defensive; but though he thus had saved their strength as much as possible, yet they were beginning to be exhausted, and their brave commander frequently turned his anxious and vigilant eye to that quarter where he expected the Prussians to arrive.

At break of day, the Prussian army had began to move; the 2d and 4th corps marched to take up a position whence they might attack the French on the rear, if circumstances proved favourable. The 1st corps was to operate on the right flank of the French; and the 3d corps was to follow slowly in order. About 5 o'clock, Bonaparte perceived the advance of part of the Prussian army, which at first he seems to have supposed to have been the division of his own army under Marshal Grouchy, who had been posted on the rear of the allies to take advantage of their anticipated defeat. As soon, however, as he ascertained that it was the Prussians, he repeated his attacks with cavalry and infantry, supported by artillery, in a more desperate and murderous manner than ever; but the British were immoveable. At last, about seven in the evening, he made a last effort, putting himself at the head of his guards. He succeeded for a moment in driving back the Brunswickers; but the Duke of Wellington, putting himself at their head, and animating them by a short speech, restored the combat. At this critical moment, the Prussians came up: General Bulow advanced rapidly on the rear of the right wing of the French; and Marshal Blucher had joined in person with a corps of his army to the left of the British army, by Ohaim. The Duke of Wellington headed the foot-guards; spoke a few words to them, which were replied to by a general *hurrah*; and his Grace guiding them on with his hat, they marched at the point of the bayonet, to close action with the imperial guard: but the latter began a retreat, in which they were imitated by the whole French army. The British, completely exhausted, left the pursuit to the Prussians, who, coming fresh to battle, soon changed the retreat of the French into a rout, the most destructive, perhaps, ever known. In this battle, nearly 300 pieces of cannon were taken, and upwards of 14,000 prisoners. The loss of the French in killed, especially on the 16th, when the Prussians neither gave nor received quarter, was immense; on the 16th and 18th, it could not have amounted to less than 40,000 men. On the 16th, the Prussians lost about 16,000 men; and on the 18th, the Duke of Wellington's army about 13,000.

Total defeat of the French,

and ruin of Bonaparte,

No battle, perhaps, ever was fought of a more obstinate description, or more decisive in its consequences. In this one battle of Waterloo, the fate of Bonaparte was sealed, and his empire again overthrown. In this one battle, the fame of the Duke of Wellington was raised to a summit it cannot possibly surpass; and the British soldiers proved that they were worthy of being commanded by such a general.

who flies to Paris, and abdicates the throne.

On leaving the field of battle, Bonaparte fled as rapidly as possible to Paris, where he arrived on the 21st, and convoked a council of ministers. On the 22d, the two chambers declared their sittings permanent; and Bonaparte was given to understand that his abdication was expected. He accordingly issued a declaration, in which he declared his political life terminated; and proclaimed his son, under the title of Napoleon II. His abdication was accepted by the Chambers; but the question was evaded with regard to the title of young Napoleon. A commission of five was chosen to exercise provisionally the functions of government: the members were, Fouche, Carnot, Grenier, Caulaincourt, and Quinette. At first, the Chambers seem to have entertained some hopes that the progress of the allies might have been arrested; but on the representation of Ney, that it was impossible to collect 25,000 men, they voted that an attempt should be made to negociate an armistice with the Duke of Wellington.

In the mean time, the Duke and Prince Blucher were advancing rapidly towards Paris. The latter was unsuccessfully opposed by Marshal Grouchy, who having united some of the fugitives from the battle of Waterloo with his corps, at last reached the capital with about 40,000 men. With these, and some of the national guards, &c. an attempt was made to prevent the Prussians from taking a position on the left of the Seine, the only part whereon defensive works had been thrown up. On the failure of this attempt, and the refusal of the Duke of Wellington to negociate an armistice, Paris was surrendered to the allies by a military convention, the principal stipulations of which were, that the French army should march out of it, and take up a position behind the Loire; that the duty of the city should continue to be performed by the national guards; that public and private property should be respected; that no person should be called to account for his conduct or opinions; and that the convention should be common to all the allied powers, provided it were ratified by the powers on whom the armies were dependant.* On the 8th of July, Louis entered his capital again, the provisional government and the chambers being previously dissolved. A few days afterwards he appointed his ministers, introducing a new regulation, according to which there is to be a privy council, comprehending the princes, the ministers, and such others as the King may name; and a council of responsible ministers. The latter are in number eight: consisting of Talleyrand, president of the council, and secretary for foreign affairs; Baron Louis, minister of finance; Fouche, Duke of Otranto, of the police; Baron Pasquier, the department of justice, and keeper of the seals; Marshal Gouvion St Cyr, the department of war; Count de Jaucour, the marine; and the Duke de Richelieu, the household. The appointment of Fouche, a man more deeply stained with the crimes of the Revolution, than perhaps any of the principal surviving actors in that dreadful drama, excited universal astonishment and indignation; but these feelings were almost entirely drawn aside from this appointment, by the state of France at the moment we are writing. The army, which evacuated Paris, for some time assumed an attitude of bold defiance on the banks of the Loire; and at length sent in a haughty, reluctant, and suspicious submission to Louis, communicated in an address from Davoust, who commanded it, more like the state paper of an independent sovereign, than the penitent submission of a rebellious and defeated general. Even after Louis had re-ascended the throne, the armies of Bavaria, Russia, and Austria, were obliged to fight their way to Paris; and in those instances, where they entered into negociations with Bonaparte's generals, the latter were left in a condition of independence on their legitimate sovereign, and almost placed on a level with the victorious allies. Notwithstanding the presence of nearly 800,000 troops of the allies, seditious cries and movements constantly agitate the very palace of Louis. In many of the provinces, a spirit of disaffection shews itself openly. In short, to judge from the present state of France, we should conclude, that it was not the conquered but the victorious country, and that Bonaparte, instead of being an exile, was still on the throne. In this alarming crisis, the measures of Louis are timid and vacillating. A few of Bonaparte's creatures, who swore allegiance to Louis, and then betrayed him, have been ordered to be arrested and tried; but it is extremely doubtful, whether this order will be followed even by an attempt to take them; and if they are taken, by whom are they to be tried? by men as guilty as themselves! The paramount feeling which thus agitates France, is that of wounded self-love; the disgrace and humiliation of being conquered, which, in the time of their success, they most insultingly poured on other nations, is returned on themselves; the demoralization which the national character has suffered during the Revolution, has become so deeply seated, and so constitutional, that the severe remedies which have been applied serve only to irritate and inflame. Hence there is reason to apprehend, that it will require a considerable length of time, and measures of consummate wisdom applied with extreme caution, to restore France to that state, in which she may become a peaceable, safe, and useful member of the community of Europe.

Paris surrendered to the British and Prussians.

The entry of Louis, 8th July.

His ministers.

Alarming state of France.

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* Although the fate of Bonaparte, after his second abdication, is rather the subject of biography than of history, yet we shall here subjoin the particulars of it. Before the allies reached Paris, he quitted that capital and went to Rochefort, where vessels were prepared to carry him and his attendants to America. The British government, however, informed of his plan, blockaded this part of the French coast so effectually, that he found himself compelled to surrender to Captain Maitland of the Bellerophon, who commanded the blockading squadron. In this ship he was brought to the coast of England, but not suffered to land; and about the middle of August, he was sent to the island of St Helena with part of his suite, to be kept there during the remainder of his life.

STATISTICS.

Statistics.

CHAP. I.

Boundaries and Extent of France—Progressive Geography—Division into Provinces and Departments—Military Divisions.

By the treaty of Paris in 1814, the kingdom of France was reduced within the same limits that bounded it previously to the Revolution; but its extent of territory was rather larger; for Avignon and the county of the Venaissin, which had formerly belonged to the Pope, but which had been incorporated with France before January 1792, were declared to be integral and permanent parts of that kingdom by the treaty alluded to.

Boundaries.

France, as it is bounded at present, is marked out, as one of the separate kingdoms of Europe, by natural limits on three of its sides. These are, the Channel between it and England on the north; the Bay of Biscay on the west, and the Pyrenean mountains and the Mediterranean sea on the south: on the east, north-east, and south-east, its limits are not accurately fixed by nature. On the east, it borders on Germany and Switzerland; on the north-east, on those provinces which formerly composed the Austrian Netherlands, but which are now united to Holland; and on the south-east, on Savoy and Piedmont. It extends from the 42½ to nearly the 51st degree of north latitude, and comprehends above 11 degrees of longitude; the most easterly part of Alsace lying 7 degrees eastward of the meridian of Greenwich, and the most westerly part of Brittany rather more than 4 degrees westward of the same meridian. Were it not for this province, which stretches about 100 miles farther into the Atlantic Ocean than any other part of the kingdom, the form of France would be almost a square, and the breadth and length pretty nearly equal, *i. e.* about 560 miles.

rea.

The area of France has been variously estimated. According to the map of the Royal Academy of Sciences at Paris, it contains 28,386 square leagues, 25 to a degree; according to the map of Delisle, 25,839. Nolin makes it 28,054; Defer, 31,278; Sanson, 31,657: the medium of these is 28,642. Busching, reckoning 15 miles to a degree, fixes the extent of France at 10,000 square miles; the Marshal de Vauban makes it 30,000 leagues, or 140,940,000 arpents; Voltaire 130,000,000 arpents. Templeman gives it an extent of 138,837 square geographical miles; but as he reckons only 60 miles to a degree, this number must be reduced to 119,224,874 acres. Panclon, by covering his map with shot to every indenture of outline, found the kingdom to contain 103,021,840 arpents, each of 100 perches, at 22 feet the perch, or $1344\frac{4}{9}$ toises square to the arpent; instead of which, the arpent of Paris contains but 900 toises. According to this measurement, France contains 81,687,016 English acres; but this is undoubtedly too few. The *Encyclopedie* assigns 100,000,000 arpents; observing that, by the map of Cassini, the amount is 125,000,000. The author of *L'Impot Abonne* calculates it at 105,000,000; and the author of *Apologie sur l'Edit de Nantes*, at 135,600,000. M. Neckar seems to have been the first who ascertained the area of France with considerable accuracy. According to him (not including Corsica) it comprehends 26,951 leagues square, of 2282 toises, or 156,024,313 arpents of Paris, which is equivalent to 131,722,295 English acres. This calculation is nearly adopted by M. Jorse, author of the *Credit Nationale*, who reckons that France contains 27,000 leagues at 2282 toises, 5785 arpents of Paris to a league, and also by Mr A. Young: This gives to France 156,225,720 arpents. The committee of the first National Assembly stated it soon afterwards at 26,463 square leagues; and this is probably pretty accurately the area of France as it is now bounded.

Statistics.

Progressive geography.

The progressive geography of this kingdom presents very different limits and divisions at different times. The ancient Gaul, as has already been remarked in the History of France, comprehended a larger portion of territory than France now contains. Under the name *Gallia*, was originally comprehended Gallia Cisalpina, and Gallia Transalpina: the former was entirely on the south side of the Alps, and the latter contained all the present France, and that part of Germany and Belgium westward of the Rhine. According to the Abbe du Fresnoy, ancient Gaul, by which he means Gallia Transalpina, was bounded on the south by the Pyrenees, the Mediterranean Sea, and the Var; on the east by the Alps and the Rhine; on the north by the same river; and on the west by the ocean. The Romans first illustrated the geography of Gaul, which they considered as divided into three chief regions, the Celtic, Belgic, and Aquitaine. The bounds of Gallia Celtica were the ocean, the Seine, the Marne, the Saone, the Rhine, and the Garonne. Gallia Belgica was bounded by the Seine, the Marne, the mountains of Vosges, the Rhine, and the ocean; and Gallia Aquitania by the ocean, Garonne, and the Pyrenees. Augustus divided Gaul into four parts; Gallia Narbonensis, which comprehended Languedoc, Foix, Vivarres, Provence, Dauphiny, and Savoy; Aquitania, which was of larger extent than it had been in the time of Julius Cæsar, and comprehended all the country between the Pyrenees, the ocean, and the Loire; Lugdunensis, the largest of all, which was bounded by the ocean, the Loire, the Seine, the Marne, and the mountains of Vosges; and Belgica, which was bounded by the ocean, the country of Caux, the Seine, the Marne, the mountains of Vosges, and the Rhine.

In the time of the Romans.

In the 4th century.

The *Notitia Imperii*, which was made in the fourth century, presents us with another division of Gaul; for there it is divided into five great provinces; Lugdunensis, Belgica, Germania, Vienensis, and Aquitania, each of which are subdivided into several others. The Emperor Constantine the Great divided Gaul into seventeen provinces or governments, six of which were consular, and eleven under certain presidents sent by the Emperor, who resided in the capital cities. The names of the provinces and the capital cities were, 1. Narbonnensis prima, capital city Narbonne; 2. Narbonnensis secunda, capital city Aix in Provence; 3. Viennensis, capital city Vienne in Dauphiny; 4. Alpes Graiæ and Penninæ, capital city Moustenon in Tarentaise, a province of Savoy; 5. Alpes Maritimæ, capital city Embrun in Dauphiny; 6. Lugdunensis prima, capital city Lyons; 7. Lugdunensis secunda, capital city Rouen; 8. Lugdunensis tertia, capital city Tours; 9. Lugdunensis quarta, capital city Sens in Champagne; 10. Sequania, capital city Besançon; 11. Aquitania prima, capital city Bourges; 12. Aquitania secunda, capital city Bourdeaux; 13. Novempopularia, capital city Auch in Gascony; 14. Germania prima, capital city Mentz; 15. Germania secunda, capital city Cologne; 16. Belgica prima, capital city Triers; and, 17. Belgica secunda, capital city Rheims.

In the time of the Franks.

After the death of Clovis, the dominion of the Franks was divided into two parts, viz. Oesterric, or the Eastern Kingdom, called by corruption Austrasia; and Westerric, or the Western Kingdom, called Neustria. The former contained all old France, as it existed in the time of Clovis; that is, all the country that reached from the Rhine to the Loire, and the country behind the Marne, which the Franks had conquered, together with Rheims, Chalons, Cambray, and Laon, which was from that time a separate kingdom, the seat of which was Metz in Lorraine. Aquitania was not comprised under the name of France; nor Burgundy, even after it had been conquered; nor the lower part of Brittania Armorica, which was at this time an independent state. Neustria contained all the country that lies between the Loire and the Meuse, and was divided into three kingdoms: 1. France, the capital of which was Paris; this comprehended what is now called the Isle of France; 2. Orleans; 3. Soissons. Afterwards, when the Franks had subdued the Visigoths and Burgundians, two other kingdoms were erected, Aquitaine and Burgundy.

Union of the provinces.

Some French historians and geographers are of opinion, that under the Merovingian race of kings, the territory of France had nearly the same limits which it now possesses; that under the Carlovingian race nearly the whole was wrested from the sovereign by the abuse of the feudal system; and that, under the Capetian dynasty, nearly the whole was recovered. The original domain of the crown under Hugh Capet seems to have consisted of Picardy, the Isle of France, and the Orleannois. Berry was the first province that was reunited to the crown: It was governed by Counts, who continued in possession of it till about the year 1100, when Eudes Aspin sold it to King Philip I. who united it to his dominions. Touraine and Normandy were confiscated to the crown, or conquered under Philip Augustus. Languedoc was next annexed, by inheritance, under Philip the Hardy; but, according to some, it was not absolutely united to the crown till the reign of King John in 1316. Champagne was governed by its Counts till 1274, at which period, Jane, who was the last Countess, was married to Prince Philip, son of Philip the Hardy; and thus this province was united to France, though the final and permanent union did not take place till 1361, in the reign of King John. The province of Lyonnois came into the possession of the crown under Philip the Fair; Dauphiny under Philip de Valois. Poitou, Aunis, Limosin, and Saintonge, were conquered by Charles V.; and Guienne and Gascony by Charles VII. Maine and Anjou were acquired by inheritance, under Louis XI. The same monarch seized the duchy of Burgundy as an escheat to the crown, and took possession of all Provence on the death of Charles, King of Sicily, who was Count of Provence. Anne of Brittany, the only daughter of Francis II. the last duke of that province, married Charles VIII. and afterwards Louis XII. by the last of whom she had two daughters, the eldest of whom married Francis I. who united Brittany to the crown of France in 1532. Under this monarch, Auvergne, Bourbonnois, and Marche, were confiscated and united to the crown. Bearn, Foix, and a part of Gascony, were the patrimony of Henry IV. and thus were united to France when he ascended the throne of that kingdom. Rousillon formerly belonged to Spain; but Louis XIII. took it in 1642, and it was afterwards yielded to France by the treaty of the Pyrenees in 1659. The house of Austria had Artois till the reign of the same monarch; but he having conquered great part of it, it was ceded to him by Philip IV. King of Spain, and afterwards by Charles II. his son. Alsace was yielded to the French by the treaty of Ryswick, in the reign of Louis XIV. Franche Compté continued subject to the house of Austria till Louis XIV. seized it in 1668, but he was obliged to restore it the next year: He seized it again in 1674, and it was confirmed to him by the treaties of Nimeguen and Ryswick. That part of the Low Countries which France retains by the recent treaty of Paris, were acquired by conquest in the reign of Louis XIV. Lorraine was the last acquisition of France before the Revolution, though part of it, the three bishoprics of Metz, Toul, and Verdun, were seized by Henry II. and yielded to France by the treaty of Westphalia in 1648: the other parts of this province, the duchy of Lorraine properly so called, and the duchy of Bar, were seized by Louis XV. and afterwards ceded to him by treaty.

Division before the Revolution and since.

Before the Revolution, France was divided into 32 distinct governments, 18 of which are in the circuit, and 14 in the middle of the kingdom. The first national assembly, by its decrees of the 15th of January, and the 16th and 26th of February 1790, divided France into 83 departments. As, however, the divisions as they existed before the Revolution are still frequently referred to, and as a knowledge of them is absolutely necessary to the right understanding of the history of this kingdom, we shall enumerate them as well as the corresponding departments. It is proper, however, to premise that each department is subdivided into 3, 4, or 5 districts, called *communes arrondissements*. These districts are again divided into cantons, and, lastly, each canton is composed of a certain number of communes, that is to say, of towns and villages. A commune is sometimes a single town, and sometimes a union of several villages, possessing a mayor and communal municipality. All the considerable cities are divided into several communes.

Flanders.

I. The province of Flanders, or the territories which France possessed in the western part of the Netherlands before the Revolution, and which she still retains. This forms the department of the North, which contains 6 districts, 60 cantons, and 671 communes; its territorial extent is 6030 kilometers,—24 kilometers being very nearly equal to 7 square miles, of 60 to a degree. The principal town in this department is Douay.

Artois.

II. The province of Artois forms the department of the Straits of Calais, which contains 6 districts, 48 cantons, and 953 communes; its territorial extent is 7042¼ kilometers; its principal town is Arras.

Picardy.

III. The principal part of Picardy forms the department of the Somme, which contains 5 districts, 41 cantons, and 848 communes. Its territorial extent is 6512½ kilometers; its principal town is Amiens.

Normandy.

IV. Normandy is divided into the departments of the Lower Seine, the Eure, the Orne, Calvados, and the Channel. The Lower Seine contains 3 districts, 20 cantons, and 79 communes; its territorial extent is 6372½ kilometers; its principal town is Rouen. The department of the Eure contains 5 districts, 36 cantons, and 843 communes; its territorial extent is 6182½ kilometers; its principal town is Evreaux. The department of the Orme contains 4 districts, 38 cantons, and 627 communes; its territorial extent is 6375 kilometers; its principal town is Alençon. The department of Calvados contains 6 districts, 37 cantons, and 896 commues; its territorial extent is 5640 kilometers; its principal town is Caen. The department of the Channel contains 5 districts, 48 cantons, and 669 communes; its territorial extent is 6890 kilometers; its principal town is Coutances.

Isle of France.

V. The province of the Isle of France is divided into the departments of the Aisne, the Oise, the Seine, the Seine and Marne, and the Seine and Oise. The department of the Aisne contains 5 districts, 37 cantons, and 853 communes; its territorial extent is 7422½ kilometers; its principal town is Laon. The department of the Oise contains 4 districts, 35 cantons, and 738 communes; its territorial extent is 6082½ kilometers; its principal town is Beauvois. The department of the Seine contains 3 districts, 20 cantons, and 79 communes; its territorial extent is 453½ kilometers; its principal town is Paris. The department of the Seine and the Marne contains 5 districts, 29 cantons, and 561 communes; its territorial extent is 6127½ kilometers; its principal town is Melun. The department of the Seine and Oise contains 5 districts, 36 cantons, and 696 communes; its territorial extent is 5880 kilometers; its principal town is Versailles.

Champagne.

VI. The province of Champagne contains the departments of the Ardennes, of the Marne, of the higher Marne, of the Aube and the Yonne. The department of the Ardennes contains 5 districts, 34 cantons, and 599 communes; its territorial extent is 6242½ kilometers; its principal town is Mezieres. The department of the Marne contains 5 districts, 32 cantons, and 699 communes; its territorial extent is 8486 kilometers; its principal town is Chalons. The department of the higher Marne contains 3 districts, 28 cantons, and 552 communes; its territorial extent is 6540 kilometers; its principal town is Chaumont. The department of the Aube contains 5 districts, 26 cantons, and 423 communes; its territorial extent is 6242 kilometers; its principal town is Troyes. The department of the Yonne contains 5 districts, 34 cantons, and 484 communes; its territorial extent is 7740 kilometers; its principal town is Auxerre.

rraine.

VII. The province of Lorraine is divided into the departments of the Meuse, the Moselle, the Meurthe, and the Vosges. The department of the Meuse contains 4 districts, 28 cantons, and 591 communes; its territorial extent is 6275 kilometers; its principal town is Bar-le-duc. The department of the Moselle contains 4 districts, 30 cantons, and 934 communes; its territorial extent is 6552½ kilometers; its principal town is Metz. The department of the Meurthe contains 5 districts, 29 cantons, and 718 communes; its territorial extent is 6430 kilometers; its principal town is Nancy. The department of Vosges contains 5 districts, 30 cantons, and 550 communes; its territorial extent is 6522½ kilometers; its principal town is Epinal.

ace.

VIII. The province of Alsace is divided into the departments of the Lower and the Higher Rhine. The department of the Higher Rhine contains 5 districts, 39 cantons, and 703 communes; its territorial extent is 6030 kilometers; its principal town is Colmar. The department of the Lower Rhine contains 4 districts, 37 cantons, and 616 communes; its territorial extent is 5695 kilometers; its principal town is Strasburg.

any.

IX. The province of Brittany comprehends the departments of the Ille and Villaine, the Lower Loire, Morbihan, the North Coast, and Finisterre. The department of the Ille and Villaine contains 6 districts, 43 cantons, and 352 communes; its territorial extent is 7185 kilometers; its principal town is Rennes. The department of the Lower Loire contains 5 districts, 45 cantons, and 209 communes; its territorial extent is 7660 kilometers; its principal town is Nantes. The department of Morbihan contains 4 districts, 37 cantons, and 231 communes; its territorial extent is 7067½ kilometers; its principal town is Vannes. The department of the North Coast contains 5 districts, 47 cantons, and 376 communes; its territorial extent is 7567½ kilometers; its principal town is Saint Brieux. The department of Finisterre contains 5 districts, 43 cantons, and 287 communes; its territorial extent is 7292½ kilometers; its principal town is Quimper.

Maine.

X. The province of Maine is divided into the department of the Maine and the Sarthe. The department of the Maine contains 2 districts, 27 cantons, and 288 communes; its territorial extent is 5452½ kilometers; its principal town is Laval. The department of the Sarthe contains 4 districts, 33 cantons, and 413 communes; its territorial extent is 6467½ kilometers; its principal town is Leillans.

Anjou.

XI. The province of Anjou forms the department of the Maine and Loire, which contains 5 districts, 34 cantons, and 385 communes; its territorial extent is 7637½ kilometers; its principal town is Angers.

Tourraine.

XII. The province of Tourraine forms the department of the Indre and Loire, which contains 3 districts, 24 cantons, and 311 communes; its territorial extent is 6452½ kilometers; its principal town is Tours.

Orleannois.

XIII. The province of Orleannois comprehends the departments of the Eure and Loire, the Loire and Cher, and the Loiret. The department of the Eure and Loire contains 5 districts, 36 cantons, and 843 communes; its territorial extent is 6182½ kilometers; its principal town is Chartres. The department of the Loire and Cher contains 3 districts, 24 cantons, and 309 communes; its territorial extent is 6717½ kilometers; its principal town is Blois. The department of the Loiret contains 4 districts, 31 cantons, and 363 communes; its territorial extent is 7047½ kilometers; its principal town is Orleans.

Poitou.

XIV. The province of Poitou comprehends the departments of Vievere, the two Sevres, and La Vendée. The department of Vievere contains 5 districts, 31 cantons, and 344 communes; its territorial extent is 7340 kilometers; its principal town is Poitiers. The department of the Two Sevres contains 4 districts, 31 cantons, and 363 communes; its territorial extent is 6337½ kilometers; its principal town is Niort. The department of La Vendée contains 3 districts, 29 cantons, and 324 communes; its territorial extent is 7242½ kilometers; its principal town is Fontenay.

Berry.

XV. The province of Berry comprehends the departments of the Indre and the Cher. The department of the Indre contains 4 districts, 23 cantons, and 275 communes; its territorial extent is 7395 kilometers; its chief town is Chateauroux. The department of the Cher contains 3 districts, 29 cantons, and 307 communes; its territorial extent is 7385 kilometers; its principal town is Bourges.

Nivernois.

XVI. The Nivernois forms the department of the Nievre, which contains 4 districts, 25 cantons, and 330 communes; its territorial extent is 7365 kilometers; its principal town is Nevers.

Bourbonnois.

XVII. The Bourbonnois forms the department of the Allier, which contains 4 districts, 26 cantons, and 350 communes; its territorial extent is 7427½ kilometers; its principal town is Moulins.

Burgundy.

XVIII. The province of Burgundy forms the departments of the Cote d'Or, the Saone and Loire, and the Ain. The department of the Cote d'Or contains 4 districts, 36 cantons, and 733 communes; its territorial extent is 9192½ kilometers; its principal town, Dijon. The department of the Saone and Loire contains 5 districts, 48 cantons, and 609 communes; its territorial extent is 8912½ kilometers; its principal town, Macon. The department of the Ain contains 4 districts, 32 cantons, and 416 communes; its territorial extent is 5675 kilometers; its principal town is Bourg.

Franche Compté. XIX. The province of Franche Compté comprehends the departments of the Higher Saone, the Doubs, and Jura. The department of the Higher Saone contains 3 districts, 27 cantons, and 640 communes; its territorial extent is 5582½ kilometers; its principal town is Vesoul. The department of the Doubs contains 4 districts, 25 cantons, and 605 communes; its territorial extent is 5340 kilometers; its principal town is Besançon. The department of Jura contains 4 districts, 32 cantons, and 728 communes; its territorial extent is 5237½ kilometers; its principal town is Lons-le-Saulnier.

Pays d'Aunis. XX. The Pays d'Aunis forms the department of the Lower Charente, which contains 6 districts, 37 cantons, and 506 communes; its territorial extent is 7247½ kilometers; its principal town is Saintes.

Saintonge. XXI. The province of Saintonge forms the department of the Charente, which contains 5 districts, 28 cantons, and 455 communes; its territorial extent is 6310 kilometers; its principal town is Angouleme.

Marche. XXII. The province of Marche comprehends the departments of the Higher Vienne, and the Creuse. The department of the Higher Vienne contains 4 districts, 26 cantons, and 224 communes; its territorial extent is 6002½ kilometers; its principal town is Limoges. The department of the Creuse contains 4 districts, 25 cantons, and 296 communes; its territorial extent is 5902½ kilometers; its principal town is Gueret.

Limosin. XXIII. The Limosin forms the department of Correge, which contains 3 districts, 29 cantons, and 294 communes; its territorial extent is 5857½ kilometers; its principal town is Tulles.

Auvergne. XXIV. The province of Auvergne comprehends the departments of Puy de Dome and Cantal. The department of Puy de Dome contains 3 districts, 50 cantons, and 458 communes; its territorial extent is 8450 kilometers; its principal town, Clermont. The department of Cantal contains 4 districts, 23 cantons, and 270 communes; its territorial extent is 5937½ kilometers; and its principal town is Aurillac.

Lyonnois. XXV. The province of Lyonnois is divided into the departments of the Rhone, and the Loire. The department of the Rhone contains 2 districts, 25 cantons, and 261 communes; its territorial extent is 2935 kilometers; its principal town is Lyons. The department of the Loire contains 3 districts, 28 cantons, and 327 communes; its territorial extent is 5135 kilometers; its principal town is Monbrison.

Guienne. XXVI. The province of Guienne is divided into the departments of the Gironde, the Dordogne, the Lot and Garonne, the Lot, Aveyron, the Gers, the Higher Pyrenees, and the Landes. The department of the Gironde contains 6 districts, 48 cantons, and 580 communes; its territorial extent is 1170 kilometers; its principal town is Bourdeaux. The department of the Dordogne contains 5 districts, 47 cantons, and 642 communes; its territorial extent is 9482½ kilometers; its principal town is Perigueux. The department of the Lot and Garonne contains 4 districts, 38 cantons, and 469 communes; its territorial extent is 6100 kilometers; its principal town is Agen. The department of the Lot contains 4 districts, 41 cantons, and 440 communes; its territorial extent is 7432½ kilometers; its principal town is Cahors. The department of Aveyron contains 5 districts, 43 cantons, and 589 communes; its territorial extent is 9477½ kilometers; and its principal town is Rhodez. The department of Gers contains 5 districts, 30 cantons, and 700 communes; its territorial extent is 7047½ kilometers; and its principal town is Auch. The department of the Higher Pyrenees contains 3 districts, 26 cantons, and 501 communes; its territorial extent is 4987½ kilometers; and its principal town is Tarbes. The department of the Landes contains 3 districts, 28 cantons, and 368 communes: its territorial extent is 9475 kilometers; its principal town is Mont de Marsan.

Bearn. XXVII. The province of Bearn forms the department of the Lower Pyrenees, which contains 5 districts, 40 cantons, and 660 communes; its territorial extent is 8072½ kilometers; its principal town is Pau.

Foix. XXVIII. The province of Foix forms the department of the Arriege, which contains 3 districts, 20 cantons, and 337 communes; its territorial extent is 5050 kilometers; its principal town is Foix.

Rousillon. XXIX. The province of Rousillon, forms the department of the Eastern Pyrenees, which contains 3 districts, 17 cantons, and 249 communes; its territorial extent is 337½ kilometers; its principal town is Perpignan.

Languedoc. XXX. The province of Languedoc is divided into the departments of the Tarn, the Higher Garonne, the Herault, the Aude, the Garde, the Ardeche, the Higher Loire, and the Lozere. The department of the Tarn contains 4 districts, 35 cantons, and 356 communes; its territorial extent is 6080 kilometers; its principal town is Castres. The department of the Higher Garonne contains 5 districts, 42 cantons, and 691 communes; its territorial extent is 8077½ kilometers; its principal town is Toulouse. The department of the Herault contains 4 districts, 36 cantons, and 333 communes; its territorial extent is 6512½ kilometers; its principal town is Montpellier. The department of the Aude contains 4 districts, 31 cantons, and 436 communes; its territorial extent is 6542½ kilometers; its principal town is Carcassone. The department of the Garde contains 4 districts, 38 cantons, 365 communes; its territorial extent is 6280 kilometers; its principal town is Nismes. The department of the Ardeche contains 3 districts, 31 cantons, and 335 communes; its territorial extent is 5710 kilometers; its principal town is Privas. The department of the Higher Loire contains 3 districts, 28 cantons, and 272 communes; its territorial extent is 5282½ kilometers; its principal town is Le Puy. The department of the Lozere contains 3 districts, 24 cantons, and 193 communes; its territorial extent is 5390 kilometers; its principal town is Mende.

Dauphiny. XXXI. The province of Dauphiny comprehends the departments of the Isere, the Drome, and the Higher Alps. The department of the Isere contains 4 districts, 44 cantons, and 558 communes; its territorial extent is 8940 kilometers; its principal town is Grenoble. The department of the Drome contains 4 districts, 28 cantons, and 360 communes; its territorial extent is 6937 kilometers; its principal town is Valence. The department of the Higher Alps contains 3 districts, 23 cantons, and 185 communes; its territorial extent is 5650 kilometers; its principal town is Gap.

Provence. XXXII. The province of Provence contains the departments of the Lower Alps, the Var, and the Mouths of the Rhone. The department of the Lower Alps con-

Statistics. tains 5 districts, 28 cantons, and 260 communes; its territorial extent is 7412½ kilometers; and its principal town is Digne. The department of the Var contains 4 districts, 32 cantons, and 210 communes; its territorial extent is 7510 kilometers; its principal town Toulon. The department of the Mouths of the Rhone contains 3 districts, 26 cantons, and 108 communes; its territorial extent is 5315 kilometers; its principal town is Aix.

Avignon. Avignon and the adjoining territory, which belonged to the Pope before the Revolution, are now incorporated with France, and form the department of Vaucluse, which contains 4 districts, 22 cantons, and 150 communes; its territorial extent is 3700 kilometers; its principal town is Avignon.

Corsica. The island of Corsica is formed into the two departments of the Golo and the Liamone. The department of the Golo contains 3 districts, 39 cantons, and 235 communes; its territorial extent is 3267½ kilometers; its principal town is Bastia. The department of the Liamone contains 3 districts, 21 cantons, and 156 communes; its territorial extent is 2955 kilometers; its principal town is Ajaccio.

Military divisions. The following are the military divisions of France, each of which is commanded by a general of division. 1. Paris; 2. Mezieres; 3. Metz; 4. Nancy; 5. Strasburg; 6. Besançon; 7. Grenoble; 8. Marseilles; 9. Montpellier; 10. Toulouse; 11. Bourdeaux; 12. Nantes; 13. Rennes; 14. Caen; 15. Rouen; 16. Lisle; 17. Dijon; 18. Lyons; 19. Perigueux; 20. Bourges; 21. Tours; 22. Bastia.

CHAP. II.

Face of the Country—Mountains—Rivers—Etangs—Sea Coast—Canals—Soil—Climate.

Face of the country. The face of the country in France is generally level; elevations, deserving the name of mountains, occurring about the centre, and in the southern provinces; and Mr Young remarks, that it is 400 miles south of Calais before we meet with the mountains of Auvergne, which are connected with those of Dauphiny, Languedoc, and Provence, but not with the Pyrenees. These, and the other mountains, we shall afterwards particularly notice: at present we shall confine ourselves to the other features of the country. The finest parts of France lie along the course of the Seine to Paris; thence by the great road to Moulins, at which place it should be left, and the road to Auvergne followed; and from hence to Viviers on the Rhine, and so by Aix to Italy. The provinces of Bretagne, Maine, and Angouleme, have, in general, the appearance of deserts: the first has been compared to the west of Devonshire; it comes, however, nearer to Cornwall. Some parts of Tourraine are rich and pleasing, but most of the province is deficient in beauty. Picardy is uninteresting, and has been called the Cambridgeshire of France. Poitou is by no means a pleasant province, and its marshes resemble the Norfolk and Lincolnshire fens. Champagne is little less interesting, in general, than Poitou. Where Lorraine, Franche Compté, and Burgundy, are well wooded, they are gloomy; and, even in the open parts of them, they are destitute of cheerfulness. The same character applies to the provinces of Berry and La Manche. The richness of Flanders, Artois, and Alsace, is rather that of utility than of picturesqueness. In the opinion of Mr Young, the province of Limosin possesses more general beauty than any other province of France: the Vivarrais and the adjoining part of Dauphiny are the most romantic. The picturesque beauty of the hilly parts of France is much increased by the rich and luxuriant verdure of the chesnut trees, particularly in the Limosin, the Vivarrais, Auvergne, and other districts where they are common.

The most level tracts are the French Netherlands on the north; on the western side, extensive morasses occur in the department of La Vendée and the adjacent districts. From the mouth of the Garonne nearly to the borders of Spain, the coast consists of a flat, sandy, and barren tract, called the *Landes*. The other parts of France are, in general, agreeably diversified with gentle risings and depressions.

Mountains. Cevennes. The principal mountains are, 1. The Cevennes, which are the principal centre of the primitive mountains of France, and extend into several branches. According to Delametherie, the principal branch runs along the river Ardeche towards Alis; another branch traverses the Rhone, on the side of Tournon and Vienne, towards the plains of Dauphiny; a third branch forms the mountains of Beaujolois, passing by Autun, &c. till it is lost at Avalone. This branch is about 70 leagues long, but in general very narrow, not exceeding in most places much above a league; the fourth branch separates the basin of the Loire from that of the Allier, and forms the mountains of Forez; the fifth branch separates the basin of the Allier from that of the Cher, and passes by Clermont to Montluçon; the sixth branch stretches towards Limoges; the seventh stretches from the Dordogne towards the Charent; and the eight divides the Dordogne from the Garonne. The lofty Cantal and Mount D'Or seem to be part of the Cevennes, proceeding from the main ridge in a north-westerly line. The northern part of the chain is styled the Puy de Dome; its elevation above the level of the sea is about 5000 feet; Cantal about 6200, and the Puy de Sausi, which is the highest point, about 6300. This enormous assemblage of rocks covers an extent of 120 miles, and is chiefly basaltic.

Vosges. 2. On the eastern border of France, the low and rounded chain of the Vosges begins, on the frontiers of Champagne and Franche Compté, and running southwards, parallel to the course of the Rhine, terminates in the Jura.

Alps. 3. A chain of the Alps crosses the three departments of the Maritime Alps, Lower Alps, and Upper Alps, and afterwards stretching to the north, divides France from the kingdom of Italy and Switzerland; perhaps the Vosges may also be regarded as a branch of the Alps. In the department of the Drome, another branch of the Alps takes its rise, which crosses the departments of the Ardeche, Loire, Rhone, Saone and Loire, and Cote D'Or, as far as Dijon.

Pyrenees. 4. The chain of the Pyrenees stretches on the south of France from the port of Vendres, on the coast of the Mediterranean Sea, to the Atlantic Ocean on the coast of Spain. Its greatest breadth is 40 leagues; its highest summit 1751 toises above the level of the sea; the length about 212 miles. Mont Perdu is the highest elevation of the Pyrenees; Mont Canigou is the chief of the Eastern Pyrenees; the hill is of difficult ascent; it is 1440 toises above the Mediterranean; the summit of it is covered with loose fragments, the ruins apparently of a rock once higher. The high cliffs of Canigou are composed of gneiss. The Pyrenean chain appears at a distance like a shaggy ridge, presenting the segment of a circle fronting France, and descending at each extremity till it disappears in the Ocean and the Mediterranean. To the south and west they present only dreadful sterility, while on the north and east the descent is more gradual, and affords frequent woods and pasture: near the summit of Mount Perdu is a considerable lake, more than 9000 feet above the level of the sea, which throws its waters into Spain.

Rivers.

Numerous rivers spread like veins through the whole of France, diffusing beauty and fertility as they pass. Of those the greatest number take their rise in the central ridge, and discharge their waters into the Bay of Biscay.

Seine.

I. The Seine rises in Burgundy, not far from Dijon; it afterwards runs through Champagne, and waters Troyes, where it formerly began to be navigable; but now it does not carry boats till it comes to Merz: at Montereau it is joined by the river Yonne; afterwards it crosses the isle of France, where it waters Melun, Corbeil, and Paris; before, however, it reaches the capital, it is considerably augmented by the Marne, and six leagues beyond Paris it receives the Oise. The principal place by which it flows, after it leaves Paris, is Rouen: it empties itself, by a large mouth, into the sea at Havre de Grace. This river carries, near Paris, heavier vessels than any other river in Europe, in proportion to the length of its course and the breadth of its channel. The whole length of its course is about 250 miles. The valley of the Seine, above Rouen, is equal in point of breadth, beauty, and fertility, to most of the river valleys in Europe. In some places it has worn its channel through about 50 strata of chalk.

Loire.

II. The Loire rises in Languedoc: its course is first to the south, then to the west, and then to the north: it afterwards turns to the north-west, near Semur, where it receives some small streams from Burgundy, which province it divides from the Bourbonnois: it next enters Nivernois, where it washes Nevers, and receives the Allier; thence running along the province of Berry, which it divides from Orleannois, it waters the city of Orleans; here it turns to the south-west, and passing Blois, Amboise and Tours, receives the Cher, the Indre, and afterwards the Vienne. It next runs by Saumur, and shortly afterwards is augmented by the waters of the Sarthe, which comes from Angers: leaving Anjou, it enters Brittany, washes Nantes, and widening its channel, in which are several islands, it falls into the sea between Croisic and Bourgneuf. Its course is estimated at 430 miles; and it is navigable to the distance of 80 or 90 miles from its source. From Angers to Nantes it is generally considered as one of the finest rivers in the world; the breadth of the stream; the islands of woods; the boldness, culture, and richness of its banks, all conspire, (in the opinion of Mr Young,) to render that part of its course eminently beautiful; but, during the rest of its course, its character changes, and it loses all its beauty. The benefits which it renders to commerce and industry are incalculable; hence it is bordered by rich and populous cities, and its banks announce fertility and abundance; but the quantity of loose sand which it carries down, renders its course uncertain and deceptive, especially from Orleans to the sea. To prevent the dangers arising from shoals, which shift with the frequent variations of the current, watermen are constantly employed in placing little branches of willows on these shoals, and in preceding large barges, which are commonly united to each other in numbers more or less considerable; a little boat always attends them, with a pilot to lay down the buoys. To confine this river to its bed, a large dyke has been constructed on both its banks, from Blois to Angers, which immense work is called *les levees*, or the *causeways*; its origin is traced back to the time of Charlemagne, and from that period care has been taken to keep it in repair. The height of these causeways is 25 feet, and their breadth 40; the middle is paved or gravelled, and the sides are protected by parapets of earth.

Garonne.

III. The Garonne rises in the valley of Adan, in Catalonia, between Valentine and St Gaudens; where its course changes from the north-west to the north-east, it receives the Ger; it receives several other small streams before it comes to Toulouse, at which place it again turns to the north-west; it afterwards forms an island, and receives the Sarebel Grenada. On its junction with the Tarn, it changes its course to the west. Several other streams fall into it, but none of any considerable note, before it arrives at Bourdeaux. Below this city it forms several islands, and receives the Dordogne, which rises in the mountains of Auvergne; after their junction, both lose their names, and are called together the Gironde. The Gironde enters the sea near the town of Cordovan, by two channels; the whole course of this river is about 250 miles. The shoals in it, between its mouth and Bourdeaux, are innumerable, and of so dangerous a nature, that few ships that get on them are ever able to get off; the bottom being a soft mud, and sandy, they make a bed for themselves, and in a tide's time are swallowed up. The Garonne begins to be navigable about Toulouse; from whence to Bourdeaux it carries the largest boats. The tide flows up nearly 30 leagues from the mouth of the river, and it is said that when it is flowing in, there appear two different levels on the surface; that which is towards the sea being considerably higher than that which is towards the source of the river.

Rhone.

IV. The great river of the south of France is the Rhone. It springs from the glacier of Furca, near the mountains of Grimsel in Switzerland. After issuing from the lake of Geneva, it takes a western course till it reaches Lyons, where it is joined by the Saone, which forces the Rhone into its own direction. Below Lyons it is joined by several rivers, the principal of which are the Isere and the Durance. Pursuing its course to the south, according to the direction which it received from the junction with the Saone, it disembogues itself into the Mediterranean by two principal channels, the one on the west, the other on the east, which form a small island called Banduff. Only very small vessels can enter this river by the west channel; the other entrance is the deepest, and by this the tartans, and other vessels which go to Arles, enter the Rhone. In several places this river seems to have changed its course. It divides itself into two branches just above Avignon, which unite again a little below it, forming a pretty considerable island. It appears from many old records and charters, that the branch which at present runs without the walls of Avignon, once had its channel where is now the centre of the town; and, by the same evidence, it is proved, that several centuries ago, there was no water at the foot of the heights on which the town of Villeneuve stands, where now runs the principal branch of the Rhone; and, by examining the country on the right bank of this branch of the river, where there is a valley, it was found that the soil of this valley is very similar to that which now forms the bed of the Rhone, and that it has the same level. It is also a well-known fact, that the river had only been kept from making its way into its former channel by means of very strong dykes; and on a ridge of rocks that border part of the valley, a number of large iron rings have been found fixed, such as might be supposed to have been placed there for the purpose of fastening boats. The entire course of the Rhone is about 400 miles. From Lyons to Avignon is about 140 miles by the river, and in nearly the whole of this course the banks of the Rhone are extremely picturesque, winding almost entirely among rocks and mountains, which present perpetual pictures to the eye. Between Lyons and Vienne, the scenery is particularly delightful: the air of this climate is balmy; the mountain scenery exhilirating; the Rhone clear, rapid, and majestic; rocks, woods, vineyards; chateaux on commanding eminences; cottages embosomed in trees, retiring from the view; the busy traffic of the river, and prosperous villages on its banks. The scenery of the Garonne from Toulouse to Bourdeaux, has sometimes been compared with that which the Rhone exhibits from Lyons to Avignon; but, though both striking, their features are of a very different character; those of the Rhone have been just described. The Garonne rolls through extensive plains, the luxuriant fertility of which cannot be exceeded; but there is little that is picturesque,—nothing that is sublime. The Saone, though it loses its name in the Rhone, deserves a short notice. It rises in Mount Vosges, and, as has been already mentioned, joins the Rhone at Lyons. The confluence of these two rivers is now about half a league below this city. It was formerly under its very walls; and the space which lies between the town and its present junction was an island called Mogniat. A plan has been formed, and partly executed, for enlarging the city, by filling up the bed of the river between the island and the main land. It is scarcely possible to conceive a greater contrast than what is presented by the two rivers, the Rhone and the Saone; the former runs with wonderful rapidity, owing to the great fall which it constantly has towards the sea; the latter is so extremely tranquil, that it is difficult to say which way the current sets. This character is preserved even at their very junction; and it is said, that a distinct line of demarcation may be observed between them, which slopes gradually off, till the character of the tranquil Saone is wholly lost, and that of the impetuous Rhone alone remains. Of the other tributary streams of the Rhone, we shall notice only the Isere, and the Durance. The former has its rise in the mountains of Savoy, and passes through the town of Grenoble. From its rising in a mountainous country, it is subject to violent inundations, and can only be crossed near Valence by a ferry boat of a peculiar construction. The Durance also rises in the mountain Genevre, on the borders of Savoy, and is full of banks and shoals, having no certain or fixed channel. Many plans have been formed at different times to render it navigable, but they have hitherto all proved abortive.

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France is almost entirely destitute of lakes. There are indeed a few in Provence and Upper Languedoc, but they are of little depth, and spread over a considerable surface of ground, and by no means either pleasing or picturesque in their appearance. Some of them in Upper Languedoc have been drained, and applied advantageously to the purposes of agriculture. On the coast of these two provinces, there are, however, a great number of inlets of the sea, which the French call *etangs*. They have a communication with the sea through a narrow channel, by which they are supplied with their waters, which are consequently salt. From the size of some of them, it might be supposed, that they were capable of being converted into harbours; but though the waters cover a great extent of ground, they are of no depth, and incapable of being navigated, except by fishing boats. The principal etang on the coast of Languedoc, is the Etang de Thou; on the coast of Provence, the Etang de Berre. The latter is about twenty miles long and sixteen broad, and communicates with the Mediterranean Sea by a narrow channel, in which are three islands.

Artesian wells.

The Artesian wells may be noticed in this place. The name is derived from the province of Artois, where the mode appears to have been originally followed; they are now by no means uncommon in the north of France. The mode consists in boring, and then driving a wooden pipe into the cavity. Through this pipe the borer is made to act, and increase the depth. Another pipe is then driven in, so as to sink the first still lower. By a continuation of this process, the length of pipe is carried to a very great depth if necessary, and water is conducted from the lower springs to the surface.

Sea coast.

Respecting the sea coast of France, we must content ourselves with a few desultory and unconnected notices. In thirty leagues of coast, Languedoc has not one good harbour, whereas Provence abounds in them. This seems to arise from the sand, and other accretions, which the Rhone brings down, being driven to the westward on the side of Languedoc; and this country being every where flat towards the sea, these accumulations elevate the shore, and render the coast extremely shelving, and full of shoals. The coast of Provence, on the contrary, is for the most part steep and rocky, and besides, inclines gradually to the southward, from the mouths of the Rhone to near Toulon. The flat marshy country on the coast of the departments of La Charente and La Vendée, appears evidently to have been once submerged by the sea. This is particularly striking in one part, where a vast marshy plain is bounded to the east by a range of cliffs, which appear exactly like cliffs on the sea shore; and to the west by the sea itself, with the islands of Rhe, Oleron, and Aix constantly in sight. In the department of Finisterre, the drift sand is very dangerous, especially during the prevalence of north north-west winds. Cultivated fields, and whole villages with their inhabitants, have been overwhelmed by it in one night. The states of Brittany maintained, at a considerable expence, a high dyke, planted with broom, and 600 toises in length, at the foot of which the sand accumulates; but this dyke is frequently broken down. From the side of Lesneven in particular, a dreadful sandhill threatens destruction to the commune of St Pol.

Canals.

The principal canals in France, are that of Languedoc, which unites the Mediterranean and the Atlantic; that of Burgundy, which joins the Loire to the Saone; those of Briare and Orleans, which unite the Loire to the Seine; and that of Calais, which communicates with the canals of the Netherlands. Referring to the article Inland Navigation for a more particular description of these canals, we shall here confine ourselves to a cursory notice of the most celebrated.

Canal of Languedoc.

I. It is supposed, that the Romans had a design to join the Mediterranean and the Atlantic nearly at the same place where the canal of Languedoc is formed. It was several times thought of during the reigns of Charlemagne and Francis I. In the year 1598, under Henry IV. this plan was again examined, and found to be practicable. Cardinal Richelieu was determined to have it executed, but was prevented by more important affairs. At length Louis XIV. appointed commissioners in 1664, to examine more narrowly the practicability of this undertaking; and in their report, the director of the king's revenue in Languedoc, M. Ricquet, undertook the execution; but it is said, according to some papers on the subject belonging to Andreossi, an able mathematician, the great work was begun in 1666, and completed in 1680. Narouse is the highest place between the two seas. Here a basin 1200 feet long and 900 broad was made, which has at all times seven feet water, which is conveyed by means of a sluice towards the ocean, and by means of another towards the Mediterranean Sea. In order that this basin may never be dry, another is made 7200 feet long, 3000 broad, and 60 deep, two sides of which are formed by two mountains, and the third by a large and strong mole, through which there runs an aqueduct, that carries the water to the other basin. Great difficulties arose in the execution of this work, in consequence of the unevenness of the ground, and the mountains, rivers, and brooks. The unevenness was remedied by means of sluices, of which there are 15 towards the ocean, and 45 towards the Mediterranean. The mountains were dug through. The most considerable of them was Mount Malpas, which was dug through the space of 720 feet. The difficulties arising from rivers and brooks, were obviated by means of bridges and aqueducts. It is 150 miles in length, and has 26 falls. The most considerable is that near Bezieres. This is at the end of a reach 30 miles in length, and the fall is so great as to require eight gates. It is 60 feet wide, and 6 deep: 12,000 men worked at it. The expence was L.1,600,000, and it costs above L.12,000 a year to keep it in order. The canal falls into the Garonne, about half a mile below Toulouse; but the navigation of the river is so indifferent till its junction with the Tarn, being full of shoals and sand banks, that the boats upon it cannot carry any depth of lading, and it often requires many of them to take the lading of one boat from the canal. It is therefore projected to carry the canal on to the Tarn, by which means the navigation between Bourdeaux and Toulouse would be greatly facilitated. The canal of Brien, so called from the Archbishop of Toulouse, afterwards prime minister and cardinal, was planned and executed, in order to join the Garonne at Toulouse with the canal of Languedoc. The necessity of such a junction arises from the navigation of the river in the Tarn, being absolutely impeded by the weirs, which are made across it for the purpose of corn mills. It passes arched under the quay to the river, and one sluice levels the water with that of the Languedoc canal. It is broad enough for several barges to pass abreast; but this canal is seldom used, and Mr Young remarks, that while the canal of Languedoc is alive with commerce, that of Brien is a desert.

Canal of Briare.

II. The canal of Briare takes it name from a small city situated on the river Loire. It was made in order to have a communication between this river and the Seine, by means of the river Loing; for which purpose they have been obliged to make the water go over hills, by means of dams and sluices. This canal was begun in the time of Henry IV. and finished under his son Louis XIII. It begins from the Loire at Briare, and passing by Montargis and Chatillon, falls into the Loing at Cepoi. Formerly the duties paid by boats amounted to very great sums annually; but they have decreased considerably since the canal of Orleans was made. By means of the canal of Briare, a communication has been opened between Paris and the sea, and even between that metropolis and all the inland provinces that are situated on the Loire, or where there are other rivers that fall into this.

Canal of Orleans.

III. The canal of Orleans begins at about two leagues distance from that city, at a place called Portmorant, and after running through the forest of Orleans, and the adjoining plain, in a course of about 18 leagues, the water being supported by several dams or sluices, it runs into the river Loing, near the place where the canal of Briare falls into it. This canal was begun in 1682, and finished in 1692, by the care of Philip Duke of Orleans, the regent's father. During the administration of the Archbishop of Toulouse, who succeeded Calonne, the canal of Picardy was projected. It begins from the Seine, a little below Paris. In passing from St Quintin to Cambray, in the line of the canal, the country rises so much, that it was necessary to carry it in a tunnel under ground for a considerable depth, even under many vales as well as hills. Near Belle Angloise, it is 10 French feet wide, and 12 high, hewn entirely out of the chalk rock, imbedded in which there are many flints. There is no masonry. The whole distance under ground, if completed, will be 7020 toises, or about 9 miles; the total estimate was nearly four millions of livres.

Other canals were projected and begum during the Revolution; the most remarkable of which was, a series of canals to unite the five great rivers, the Rhine, Rhone, Garonne, the Seine, and the Loire. The two former were to be united by a canal from the Rhine at Baale to the lake of Geneva, passing through the lake of Neufchatel. Another canal from Beaucaire to the Etang de Thau, where the canal of Languedoc empties itself, was to unite both the above rivers to the Garonne; and, lastly, by the restoration of a canal formerly made from the Rhone near Lyons, to the Loire at Roanne, all these rivers were to be united; the Seine already communicating with the Loire by means of the canals of Briare and Orleans. It was also proposed to restore a canal which was made in the time of Caius Marius, to supply the want of a safe and commodious navigation at the mouths of the Rhone. Some remains of this canal are still in existence, and are known by the name of the *Fosse Marine*. This canal of Marius was cut from the port of Bourc, near the Etang de Berre at Arles; and through this his vessels could pass with security into the Rhone. The restoration of this canal would be a great benefit to the town of Arles; but these projected canals, though frequently they served to fill up the annual *exposé* of the French government, were either not begum, or not carried on to their accomplishment.

Soil.

The soil of France varies much in different parts of the kingdom; but it may be remarked, that there is scarcely any kind of soil in it, which in England could be called a clay soil. The soils may be classed as follows:

Loam.

I. Fat loam, of different degrees of tenacity. The northern district of this soil extends over the provinces of Flanders, Artois, Picardy, Normandy, and the Isle of France. On the coast, it may be said to extend from Dunkirk to Carentum in Normandy. From thence to Coutances, the land is chiefly poor and stony, and continues so, though with some variations, to Brest. In a line a little to the south of the coast before Caen, the first considerable change of soil from Calais is seen. In Normandy, on the side of Alençon, rich loams on a calcareous bottom are met with. From Dunkirk to Nemours is not less than 180 miles in a right line; from

Loam.

Soissons to Carentan is another right line of about 200 miles; from Eu, on the coast of Normandy, to Chartres, is 100 miles. The breadth of this rich district in some places, especially about Caen, &c. is not considerable, yet the whole will be found to contain not a trifling proportion of the kingdom. The fertile plains of Flanders and of Artois, are perhaps the richest parts of this valuable soil, which here consists of deep friable mould, rather inclining to clay than sand, on a calcareous bottom, bearing evident marks of having once been covered by the sea. From Paris to near Cambray, by the road of Soissons, this loam is more sandy, but equally valuable and fertile. About Meaux, there is as fine soil as can possibly exist. It consists of an almost impalpable powder, and of admirable texture and friability. In some places it is 18 feet deep, resting on a stratum of white marl. The line from Paris through Picardy is inferior; but all the arable part of Normandy, which lies within the limits above described, is a rich, friable, sandy loam, in some places of a reddish colour, and very deep. The calcareous loams are of much greater extent than the loams which have been described. To the east, they stretch across Champagne. From Metz to Nancy, all is calcareous, but not chalk. In the southern parts of Alsace, limestone land abounds. Immense districts of Dauphiny and Provence consist of the same kind of soil. Indeed, the chalk district extends east to about St Menehould, and south to Nemours and Montargis, or even farther, for it reaches Auxerre in another direction. There is also much calcareous loam in Angoumois, Poitou, and through Touraine to the Loire. Most of the course of this river is calcareous. The chalk district, therefore, may be regarded as stretching not less than 200 miles east and west, and about as much, but more irregularly, north and south. The next considerable district of fertile soil, is the plain of the Garonne. Through all this plain, wherever the soil is found excellent, it consists usually of a deep, mellow, friable, sandy loam, sufficiently moist, and in many places calcareous. The plain of the Garonne is entered about Creissensac, in passing to the south from the Limosin. Its fertility increases all the way to Toulouse, where it is uncommonly rich. Its richness, however, diminishes as we approach the Pyrenees. The breadth of this plain is every where inconsiderable. Another tract of rich soil is found in the vale, which stretches from Narbonne to Beziers, Montpellier, and Nismes; but its fertility is inferior to those that have been previously described. The soil of the Lower Poitou resembles that of the richest parts of the Lincolnshire fens, and is indeed of the same nature, being for the most part marshy land drained, or gained from the sea. To the south of the Loire, in the direction of Bourgneuf, there is a tract of rich loam. Alsace, in respect to soil, resembles Flanders, but it is inferior to it. The whole fertile part of the narrow plain of Alsace, hardly presents a surface of more than 1000 square miles. The flat, and chiefly calcareous vale of Auvergne, which commences at Riom, is a tract of great fertility. The whole surface is a real marl, but mixed with such a proportion of soil as to be most valuable and productive. The French naturalists who have examined it, assert the depth to be 20 feet of beds of earth, formed of the ruins of what they style the primitive and volcanized mountains. The best part of this vale reaches no farther than from Riom to Vaires, scarcely more than 20 miles. Mr Young calculates, that the whole of the fertile districts of France, which we have just described, amounts to about 28 millions of English acres.

Heath district.

II. The district of heath is chiefly in the provinces of Brittany, Anjou, parts of Normandy, and Guienne, and Gascony. The five departments into which Brittany is divided, are reckoned to contain 1609 French square miles; the cultivated land amounts, according to some calculations, to less than one-third, and the heaths to 3,006,000 acres; according to other calculations, two-fifths of the whole province are uncultivated; and some authors assert, that of 39 parts 24 are *lande*, which amounts to three-fifths. Some of the heaths are so extensive, that a house is scarcely seen in ten leagues. The soil of the best part of the heaths in Brittany, is commonly gravel, or gravelly sand on a gravelly bottom, of a very inferior and barren nature. In many places it rests on sandstone rock: none of it is calcareous. Anjou and Maine are equally noted for the immensity of their heaths, which are reported to extend 60 leagues in one place. The soil of these heaths is, however, in some parts tolerably good, and might be rendered useful by proper skill and labour; consisting of gravel, sand, or stone, generally a loamy sand or gravel. The *Landes*, as they are emphatically called, lie west from Bazadois and Condomois to the sea coast, between the country of Labour on the south, Guienne on the north, and the ocean on the west. They are divided into the greater Landes between Bourdeaux and Bayonne, and the lesser between Bazas and Montmarsan. They are sandy tracts, covered with pine trees, cut regularly for resin, broken and enlivened however with cultivated spots for a league or two. When the Moors were expelled from Spain, they applied to the court of France to be allowed to settle on, and cultivate these lands; but permission was not granted them. They are said to contain not less than 300 square leagues, or 1,468,181 English acres, occupying a large portion of Gascony. Though the soil of these Landes is among the poorest in France, it is not utterly incapable of cultivation, and even the pines with which it is covered yield from 15s. to 20s. an acre.

Chalk district.

III. The district of chalk, as distinguished from the calcareous loams already noticed, is chiefly in the provinces of Champagne, Sologne, Touraine, Poitou, Saintonge, and Angoumois. The chalk provinces contain 16 millions of acres. The soil of Champagne in general is thin and poor. The southern part, as from Chalons to Troyes, has from its poverty acquired the name of *pouilleux*, or lousy. Sologne is one of the poorest and most unimproved provinces in the kingdom. It is a flat, consisting of a poor sand, or gravel lying every where on a bottom of clay or marl, so very retentive of water, that every ditch and hole is full of it, except in the dryest seasons. Touraine is better. It contains some considerable districts, especially on the south of the Loire, in which good mixed sandy and gravelly loams rest on a calcareous bottom. Considerable tracts in the northern parts of the province, however, are of a very inferior soil, not better than the predominating soil of Anjou and Maine. Poitou consists of two divisions, the upper and the lower, the latter of which has already been mentioned as resembling the fens of Lincolnshire. The upper division is generally a thin loam, on an imperfect quarry bottom,—a very inferior *stone brash*. A great part of Angoumois is a thin and poor chalk.

times so severely wounded by the hail as to occasion their death; and it has even been asserted, that men have been known to be killed by the hail, when they could not procure shelter.

Division of the climate into four zones.

The climate of France naturally divides itself into four zones, according to the vegetable produce which each affords. The most northern of these divisions bears a considerable resemblance, in its vegetable produce and in its climate, to England: the second differs from the first principally in exhibiting here and there a few vineyards: in the third, fields of maize begin to make their appearance; and the fourth is distinguished from the preceding by the intermixture of olives, mulberries with corn, vines, and maize. The line of separation between vines and no vines is at Coucy, ten miles to the north of Soissons; at Clermont in the Beauvoisis; at Beaumont in Maine; and Herbignac, near Guerande in Brittany. The line of separation between maize and no maize is first seen on the western side of the kingdom, in going from the Angoumois and entering Poitou, at Verac, near Ruffec: in crossing Lorraine, it is met with between Nancy and Luneville. If these lines between vines and no vines, and between maize and no maize, be drawn on the map of France, it will be found, that they proceed in an oblique line from the south-west to the north-east, being parallel to each other. The line which the vines forms is nearly unbroken; but that formed by the maize in the central part of France, proceeds no farther north than the southern part of the Limosin. The line of olives is also pretty nearly from south-west to north, in the same oblique direction. In proceeding to the southward from Lyons, they are first met with at Montelimart; and, in proceeding from Bezieres to the Pyrenees, they are lost at Carcassone. Hence it appears, that there is a considerable difference between the climate of France in the eastern and western parts; the eastern side of the kingdom indicating, by its productions, 2½ degrees of latitude of more heat than the western.

Having made these general remarks on the climate of the different parts of France, we shall next proceed to lay before our readers an abstract of the most careful meteorological observations, as they respect the thermometer, barometer, winds and rain.

Temperature.

I. The annual heat of London and Paris is nearly the same; but, from the beginning of April to the end of October, the heat is greater at Paris than at London. If the annual temperature of London be represented by 1000, the average degree of cold in January by 1000, and the average degree of heat in July by 1000, the annual temperature of Paris may be represented by 1028; the average degree of cold of Paris in January by 1040; and of heat in July by 1037. The annual temperature of Bourdeaux will be represented by 1090; the average degree of cold in January by 925; and the average degree of heat in July by 1139. The annual temperature of Montpellier will be represented by 1170; the average degree of cold in January by 850; and the average degree of heat in July by 1196.

In the centre of France, the greatest heat averages 27 degrees of Reaumur's thermometer, and the greatest cold 7 degrees: in the north of France, the greatest heat is 23° 2', and the least 6° 6': in the east of France, the greatest heat is 24° 3', the least 9° 5': in the west of France, the greatest heat is 24°, and the least 6°. In the south-east, at Montpellier, the greatest heat is 28° 1', the least 3° 7'. At Marseilles, the meteorological observations of nine successive years gave an average of 25° 3' for the greatest heat, and 3° 1' for the least.

Barometer.

II. In the neighbourhood of Paris, the barometer never continues twenty-four hours without changing. The barometer rises and falls sooner in the western districts than in the eastern. M. Burckhardt, after 15,000 barometrical observations, in order to calculate the influence of the winds on the barometer in France, found that the south wind gave, for a mean height, 27 inches 11.3 lines, while an east wind raised the mercury to 28 inches 1.9 line. He also found, that the height of the barometer on the Mediterranean shores of France was 28 inches 2.2 lines, while its height on the Atlantic shores was 28 inches 2.8 lines.

In the centre of France, the greatest height of the mercury in the barometer, on an average of several years, is 28 inches 5.7 lines, its least height 27 inches 3.3 lines: in the north of France, the greatest height is 27 inches 10.10 lines, the least 26 inches 8.5 lines: in the west, the average height of the mercury in the barometer is 28 inches 3 lines: in the north-east, at Montpellier, the greatest height is 28 inches 5.8 lines, the least 27 inches 5.5 lines. At Marseilles, the greatest height of mercury in the barometer is 28 inches 7.2 lines, the least 27 inches 3.7 lines.

Winds.

III. It appears from the result of observations made by M. Cotte, at 86 different places in France, that along the whole south coast of that kingdom, the wind blows most frequently from the north, north-west, and north-east: on the west coast, from the west, south-west, and north-west; and on the north coast, from the south-west. In the interior parts of France, the south-west wind blows most frequently in 18 places; the west wind in 14; the north in 13; the south in 6; the north-east in 4; the south-east in 2; the east and north-west, each of them, in one. About Dunkirk, according to the same author, the prevailing winds are the south-west. As, however, the result of other observations differ from those given by M. Cotte, we shall subjoin them.

According to these observations, in the centre of France, the prevailing winds are the south-west and north-east; in the northern districts the south-east wind is most common; in the eastern districts the north and south-west winds; in the west of France the north-east is the prevailing wind; in the south-east at Montpellier, the north and north-east are the prevailing winds; and at Marseilles the south-east and north-west.

Rain.

IV. The mean quantity of rain that falls at Paris is 22 inches; the evaporation is generally greater than the rain; the mean evaporation being 33 inches. In the centre of France, the average quantity of rain is rather more than 20 inches; the number of rainy days in the course of the year 164. In the north of France there are 126 rainy days; in the east 145; in the west 150 rainy days; in the south-east, at Montpellier, there are 74 rainy days, and the quantity of rain is upwards of 27 inches—a proof of the violence of the rain when it does fall. At Marseilles, the quantity of rain is rather more than 21 inches, and the number of rainy days 57.

CHAP. III.

Natural History—Mineralogical Geography—Basin of the Seine—Basaltic district of Auvergne—Geology of the Pyrenees—Strata in different parts of France—Miscellaneous Mineralogical remarks—Mines of Gold, Silver, Copper, Iron, &c.—Coal Strata and Mines—Jet, &c.—Salt Springs of Salins, &c.—Mineral Waters—Natural Curiosities—Botany of France—Zoology.

As our limits will not permit us to enter minutely and fully into the natural history of France, we shall content ourselves with noticing, in the first place, the most important and curious features of its mineralogy and geology; subjoining to this notice, an economical account of the principal mines, and a brief sketch of the mineral waters and natural curiosities most deserving of attention: in the second place, the Botany of France: and, lastly, the most interesting parts of its Zoology.

Mineralogy and geology.

I. With respect to the *mineralogy* and *geology* of France. Modern French geographers, in a branch of that science, to which they have properly given the epithet *physical*, have divided the kingdom into what they call *basins*; that is to say into several great plains, through which the principal rivers flow, and which are formed of several ridges of mountains, either *original*, that is of granite, or secondary, of calcareous and other materials. Of these *basins*, the chief are, 1*st*, The basin of the Loire, and all the rivers that fall into it. 2*d*, of the Seine and its branches. 3*d*, Of the Garonne. 4*th*, Of the Rhone and Saone. There are likewise some smaller ones, but of much less account.

Basin of Paris.

As the basin of the Seine, or of Paris as it is frequently called, is the most interesting to the geologist, and has moreover been very carefully and scientifically illustrated by the labours of Messrs Cuvier and Brogniart, in their Memoir on the Mineralogical Geography of the environs of Paris; of M. Lamanon, in his Memoir on the gypsums and their fossil bones; of M. Desmarets in his description of Montmartre, and by other authors, we shall confine our account to this basin.

The basin of the Seine is separated for a long space from that of the Loire, by an extensive high plain, the greater part of which bears the name of Beauce. This plain is bounded towards the north-west by a higher and more broken district, from which the rivers Eure, Aure, Orne, Maienne, Sarte, &c. arise. On all other sides, the plain of Beauce overlooks every surrounding district. The slope from it, towards the Seine, is divided into two inclinations, one of which, on the west, looks towards the Eure, and the other, on the east, looks towards the Seine. These two inclined plains, however, are not straight, but in all directions unequal and rugged, the slopes are generally very abrupt, and all the ravines, valleys, and wells dug in the high parts, shew that one prodigious mass of fine sand covers the whole surface, passing equally over all the other soils, or inferior platforms, which this great plain overlooks. The edge of this platform, towards the Seine, forms the natural limit of the basin of Paris, on this side. From below the two extremities of this platform, issue two portions of a platform of chalk, which extends in every direction to a great distance, forming the whole of Higher Normandy, Picardy, and Champagne. In some parts of the two latter provinces, the chalk is covered with sandy platforms, similar to that of Beauce.

Hence it appears that the materials which compose the basin of Paris have been deposited in a vast gulf, the bottom of which is chalk. This chalk lies in horizontal beds, with flints, and is wholly, or in part, covered by certain argillaceous, siliceous, calcareous, gypseous, and alluvial strata. The basin, measuring directly from Epernay to Gisars, nearly from east to west, is 87 English miles in length, and from Nemours to the neighbourhood of Noyon, nearly south and north, it is 70 miles broad. On the south-west, from near Nemours to the mouth of the rivulet called the Maulde, a direct distance of about 45 miles, it is limited by a covering stratum of Beauce sand, and in all its remaining sides by the naked chalk stratum. The chalk is undoubtedly the most ancient, and the sandy platform the most recent of the formations in this basin. Between them there are two great strata; the first, lime, either siliceous, containing no shells, or lime with coarse shells; the second, which is named by the French geologists *gypso-marley*, is not generally spread, but merely scattered in spots, very different from one another in thickness and in their component parts. These two intermediate soils or strata, as well as the two extreme strata of chalk and sand, and all the vacuities which they have left, are partly filled by a fifth sort of soil, mixed also with marl and silex, which may be called *fresh water soil*, because it abounds in fresh water soils only.

Strata in the basin of Paris.

If each of these large strata, however, are subdivided, there will appear 10 distinct kinds of strata in the basin of the Seine. Of these we shall give a short sketch, beginning with the lowest.

1. Chalk, either in distinct beds and with few flints, or with many layers and nodules of flint, constitutes the first formation. In it are found 50 species of fossil remains.

2. The second formation consists of plastic clay; white, grey, slate-grey, and red potter's clay, from four inches to 52 feet or more in thickness. This contains no fossils, but in some parts fragments of bituminous wood.

3. The third formation consists of sand, coarse, red, or bluish grey, without fossils;—of coarse limestone in beds, alternating with their marls and clay; the lower beds are sandy, containing greenish earth, and though hard, decompose quickly on exposure; they contain extraneous fossils in good preservation, amounting to more than 600 species;—of soft greenish earth, exhibiting on its lower surface brown marks of leaves, and stalks of vegetables;—of grey and yellowish strata, of different degrees of hardness, and of building stone rocks; these contain shells;—of hard earth, containing seams full of shells;—of hard calcareous ruble marl, and soft calcareous marl beds, without fossils;—of calcareous sand, sometimes agglutinated, and containing chert, quartz crystals, and variegated crystals of carbonate of lime; and of hard calcareous ruble marl, and soft calcareous marl beds without fossils.

4. The fourth formation is still more various than the third; it consists of two distinct parts, viz. the fresh water formation, containing a mass of selenitous gypsum in thin beds, with numerous marl beds; without organised fossils; next marl strata; then a second mass of gypsum beds, with thin marl beds, containing fossil fish; then marl strata again, and above them another mass composed of three parts, with marl strata in-

so found near Paris; fibrous gypsum, near Riom in Auvergne, in the volcanic district; and gypseous alabaster in Franche Compté, and at Lagny on the Marne, about 20 miles from Paris. Fluor spar is abundant in France, occurring in almost inexhaustible mines, in the primitive mountains of Gyromagny, in the Vosges, in the neighbourhood of Langeac in Auvergne, and at Fores; it is also found in the mountain of Pilat, not far from Lyons. Basalt, or perhaps whinstone, alternating with limestone, occurs near Villeneuve-de-Berg, a town in the department of the Ardeche, 12 miles north-west of Viviers. The coal mines of France will be afterwards noticed: at present we shall confine our remarks to a singular dyke that has been discovered in the coal field in the district of Boulogne. It runs in the form of a crescent from north to west, and consists of a species of marble, found in several quarries in the vicinity. This dyke has been traced to the perpendicular depth of 600 feet, where it is succeeded by a schistus rock, and this, following the same course and inclination, continues to intersect the horizontal strata. Granite dykes, from an inch to six feet in thickness,—the quartz, feldspar, and mica of which are of larger size than are usually found in the granite of mountains,—occur on the great road between Limoges and Cahors, traversing horizontal strata of argillaceous schistus, a species of stone that has generally been considered of later formation than granite.

Metallic veins and ores.

2. *Metallic veins and ores.* The economical account of the mines of France will be afterwards given. Our subject at present is purely mineralogical. Small quantities of native cinnabar, sooty silver ore, red silver ore, and corneous silver ore, are found in France; the last at Allemont, where black silver ore also occurs. Of the ores of copper, France possesses native copper, and yellow copper ore. Native iron occurs at Oulli, near Grenoble. The chromate of iron has been found in considerable abundance in veins and nodules, in beds of serpentine, in the department of the Var. Of the ores of lead, brown lead ore, a very rare species, occurs in the lead mines of Brittany. In them also native bismuth is found. Native antimony, a very rare species, striated sulphuretted antimony, and red antimonial ore, are found at Allemont in Dauphiny, where occur yellow cobalt ochre, red cobalt ore, and sulphuretted nickel. It is worthy of remark, that antimony has been found at this place imbedded in a matrix of pit-coal. The manganese mine at Romanèsche, in the department of the Saone and the Loire, is distinguished by the following particulars. 1. It contains a very considerable quantity of sulphate of barytes, about one-sixth of the mass, not accidentally mixed, but in a state of chemical combination. 2. The total absence of iron from its composition is the more extraordinary, because the affinity between these substances is so great, that few iron ores are destitute of manganese; and no other instance of manganese devoid of iron has been found. 3. The hardness of those portions of the ore that contain the least quantity of oxygen is so considerable, that they not only scratch glass, but even rock-crystal, and give bright sparks when struck. 4. When plunged for a minute in water, the variety that contains the least quantity of oxygen absorbs a certain quantity of the liquid; and when taken out of it, emits a very strong argillaceous odour, though no clay has been detected in its composition. 5. In the same circumstances, that variety which contains a larger portion of oxygen, rapidly absorbs a great quantity of water, with a hissing noise, and disengagement of air. The odour which it then exhales is very strong; but though approaching to the argillaceous, it produces a different sensation, which it is very difficult to describe. Sulphuretted molybdena is found at Tillot; micaceous uranitic ore near Autun; and titanite at St Yrieux. Octahedrite, another species of the titanium genus, has been found lining the cavities of a vein, accompanied by quartz and feldspar, in a primitive rock in Dauphiny.

3. Having enumerated the most remarkable of the compound rocks, and metallic veins and ores, we shall now notice the other mineral substances, not included in these two classes.

Earths and stones.

Earths and stones. Of the genus Zircon, the hyacinth has been found in the rivulet Expailly, in the department of the Upper Loire. Of the siliceous genus, Olivine is found in the Vivarrais; grenatite in Brittany; the emerald, of a bad colour and confused crystallisation, however, has lately been discovered in the vicinity of Limoges; the beryl, in a large vein of quartz, traversing graphic granite; the tourmaline, the pistazite, or glassy actinolite of Kirwan, in Dauphiny, on the surface and in the fissures of an argillaceous rock, accompanied by quartz, amianthus, and feldspar, and in the Pyrenees in limestone;—thummerstone in the Pyrenees;—the amethyst in Auvergne;—aventurine, a variety of common quartz, held in considerable estimation, has been found near Vastes, in the department of the Two Sevres, in the form of rounded stones, that are reddish. In the department of Jura, globular masses of flint occur, with cavities containing sulphur. Chalcedony, in thin layers, alternating with gneiss; and agate, imbedded in granite, containing nodules of the same granite, and penetrated with iron pyrites, have been found near Vienne, in the department of the Isere; menilite, the pitch-stone of Kirwan, at Menil Montant, near Paris; veins of prehnite, in Dauphiny; laumonite, or efflorescent zeolite, in the lead mines of Huelgolt, in Brittany; andalucite, the adamantine spar of Kirwan, was first discovered in the granitic rocks of Fores, in the department of the Rhone and Loire, where it occupies a vein of common feldspar; hollow spar, a subspecies of feldspar, is imbedded in argillaceous schistus, in the mines of Brittany.

Argillaceous genus.

Of the argillaceous genus, porcelain earth is found at Limoges and Bayonne. Adhesive slate forms considerable beds at Menil Montant, in which beds the menilite already noticed is found. The mountain of Averne, near Frejus, which abounds in mineral productions, presents large quantities of a sort of micaceous sand, resembling silver and gold, which, by reflecting the rays of the sun, produces the most brilliant effect. So rich do these sands appear, that a representative of the people, not versed in the study of mineralogy, crossing this mountain in 1793, eagerly collected a quantity of this beautiful sand, and carried it with him to the Convention, as a proof of the negligence of the administrators of the department of the Var, who trod under their feet treasures adequate to sustain the expence of the war against all the kings of the universe. Basalt, lava, indurated lithomarge, &c. are also found in France.

Snow of a very bright-red colour has sometimes been found on the summits of the highest mountains. The matter which colours it, burns with a smell similar to that of a great many vegetable substances. Saussure, who often collected such snow on the Alps, was induced, by this property, as well as by its being found in summer, and in places where a great many plants were in flower, to consider the colouring matter as the farina of some plant. Ramond, who found this dust on the snow of the Pyrenees, having remarked that it is heavier than water, suspected it to be of mineral origin; and on analysing it, he found that it arose from a decomposition of certain micas.

Of the magnesian genus, fullers' earth, though not so good in quality, nor so abundant as in England, is found in France. There are also other species of this genus, but none that require particular notice.

Of the calcareous genus, the great body of chalk which traverses France from Champagne to Calais has already been mentioned, and also the marbles of the Pyrenees, and the marls and gypsum in the vicinity of Paris, as well as the other most interesting species of this genus, that occur in France.

arytic enus.

Of the barytic genus, sulphate of barytes has been found in the province of Auvergne; and in 1798, M. Lelievre discovered the sulphate of strontian in a striated mass; it was about the depth of 15 or 16 feet in clay, which had been digging for some years before at Bouvron near Toul.

Petroleum and asphaltes are found in great abundance in Alsace, in a bed of sand, but upon two beds of clay or argillaceous schistus. Auvergne also contains abundance of fossil pitch, which exudes in a warm season from a rock impregnated with it through its whole mass.

The organic remains found in the basin of Paris have already been noticed. They also occur in other parts of France; but we can only afford room for the following instance. At St Chaumont, near Lyons, is found an argillaceous schistus covering a bed of coal, every lamina of which is marked with the impressions of the stem, leaf, or other part of some ferns, all of species not only not found in France, but peculiar to the East Indies, or the warmer climates of America. The fruit of a tree which grows only on the coasts of Malabar and Coromandel was also found here.

We shall now proceed to the economical account of the mineral productions of France.

es.

The only mine of gold which in modern times has been wrought in France, was discovered in 1791, at Gardette, in the valley of Oysans, in the department of the Isere. This was a regular vein of quartz, traversing a mountain of gneiss, and containing auriferous sulphuret of iron, and some fine specimens of native gold; but it was not sufficiently rich to defray the expence of the operation. Many of the rivers of France contain auriferous sand, as the Rhine, the Doubs, the Garonne, the Ardeche, and several of the small rivulets which flow from the Pyrenees; and it is said that gold is also found among the black sand, and particles of morassy iron ore, in the neighbourhood of Paris.

There are silver mines at St Marie-aux-mines in Alsace, at Girogmany in the department of the Upper Rhine, near the mountains of Vosges, also a part of Alsace; and at Allemont in Dauphiny; but silver is most commonly attached to the lead and copper ore; and the former metal in some parts of France is particularly rich in this respect, containing for every quintal of lead nearly 16 ounces of silver.

Iron is found in abundance, particularly in the north-eastern departments. The ore is not unfrequently found in large lumps on the surface, and the strata are most commonly but a few feet below it. The Pyrenees abound in large banks containing iron ore. There is an iron mine of considerable repute at Vicdessos, situated very high in these mountains, about 15 miles to the south-west of Tarascon, and not far from the frontier of Spain. The "chantiers," or places where the ore is dug, are some hundred fathoms deep; and the passage to them in many parts very narrow and steep. Up these passages the ore is brought with amazing toil, on the backs of the miners. Some carry 100 lb. some 120 lb. and some even more, according to their strength. The mine is the property of government. There are generally 400 persons at work in it, under inspectors, but paying themselves by the sale of the ore to the forge masters. It is miserably wrought, without a single improvement, Mr Birkbeck supposes, since the days of Julius Cæsar. The ore is rich, and containing calcareous spar, is reduced without the addition of any other substance. It lies very irregularly, under lime of a schistose appearance. The mass of ore is in some parts upwards of 60 feet in thickness. The miners are mostly proprietors of land. The whole surface of the mountain is divided in patches of different dimensions, all cultivated and watered with the utmost assiduity, and clothed with luxuriant vegetation. There are also abundant mines of iron in Upper Languedoc, in the mountains of the Rouergue, which bound the western part of the province; and in the county of Foix, which joins Languedoc to the south, there is a mine of iron, so extensive, that it has supplied 40 founderies for upwards of two centuries. In these parts, the furnaces to the iron founderies, instead of being blown with bellows, are supplied with a current of air, by means of water precipitated through a vertical tube, to which is given the name of a *trombe*, the same word which is used in France for a water spout. This practice is of very ancient standing. There are also iron mines in Franche Compté, Lorraine, Champagne, Berri, &c. Great attention has been paid to the working of all the iron mines, since the Revolution. The number of forges for the working of iron and steel are computed at nearly 2000; but these included the forges in those departments in the north-east, which no longer belong to France. Before the Revolution, France imported iron to the annual value of 11 or 12 millions of livres. A great quantity of steel is still imported from Germany into France.

Copper.

There are some rich copper mines in the Pyrenees, in the departments of the Rhone and the Upper Alps, in the mountains of Rouergue, in the departments of the Loire, the Lozere, and the Ardeche, and in Saint Marie-aux-mines, near the mountains of Vosges. The principal copper founderies are at Saint Bel, Lyons, Avignon, Bedarieux, Montpellier, &c. Formerly almost all the copper used in France was brought from Sweden.

Lead.

Two-thirds of the lead of France are from Brittany, particularly the mines of Poullaoven and Huelgoet. There are also lead mines in the department of the Channel; but they have been repeatedly abandoned, in consequence of a deficiency of coal for working them. Mines of lead also occur in the departments of the Maritime Alps, the Lozere, Ardeche, &c. and in the Mountains of Vosges. Most of those that are worked, yield silver at the same time.

Antimony.

France possesses mines of antimony, which might suffice for supplying all Europe with that commodity. The principal ores are those of Creuse, Cantal, the Higher Loire, La Vendée, the departments of the Ardeche and Allier, and at Allemont in Dauphiny.

Zinc.

Zinc is the most common of the French semi-metals. It is found in three states in the mines; viz. in blende, white vitriol, and lapis calaminaris. The latter is very abundant at Saint Sauveur, in the Cevennes, at Pierreville in the department of the Channel, at Montalit near Bourges, Saumur, and other places.

Cobalt.

Cobalt is found in the silver, and bismuth in the lead mines. The former is chiefly met with in the mines of Alsace; and bismuth in the mines of Brittany, Saint Sauveur, &c.

Manganese.

Manganese is in great abundance. The mine of this metal at Romanéche in the department of the Saone and Loire, has already been noticed. It also occurs in the departments of the Loire and the Vosges, and near Perigord, whence it is sometimes called *Pierre de Perigord*.

Mercury.

The only mine of mercury that is now wrought, is at Menildot, in the department of Calvados. The quicksilver mines in the department of the Channel have been abandoned.

Before proceeding to our economical account of the coal mines of France, we shall notice some particulars connected with their mineralogical and geological character, which we thought it better to refer to this place.

Coal strata in Provence.

The coal strata of Provence are situated at the foot of the highest mountains of Lower Provence; they run along a soil of a whitish red colour, and traverse a pretty uniform range of hills, whose internal structure presents nothing very remarkable to the ordinary observer. To the first layer of earth, a bed of stone succeeds, of various thickness, and followed by a layer of earth of the same nature as the first, which in turn reposes on new beds of hard stone. This series continues to a variable depth, and then the earthy layers are no longer seen. They are succeeded by those of coal, which are always included between beds of limestone. These are seldom of any considerable thickness, have a foliated texture, and in proportion as they approach to the coal, change their colour from a cloudy white to a blue of a lighter or deeper shade: hence they might at first sight be regarded as schistose, though they are unquestionably calcareous, and abound in marine and river shells. This disposition of the coal strata of Provence extends over a district of more than 20 leagues in length; but the thickness of the seams seldom exceeds two or three feet. This situation of coal is curious, as it puts beyond a doubt the existence of coal in limestone, which had been long denied. The coal of Alais, a town in the department of Gard, near the foot of the Cevennes, presents a mixture of calcareous matter, and is often burnt for the express purpose of obtaining lime. The geology of this provincial district of France also furnishes an instance of the occasional interposition of layers of peat earth between those of coal, though it may be doubted whether the alleged peat may not more properly be classed with vitriolic or bituminous earth, or even perhaps with fossil wood. Many of the coal strata in France are encompassed by primitive rocks; while most of those in England and Flanders are insulated in secondary soil.

Other coal mines.

The other most considerable coal mines in France are those in the Lyonnois at Forez, in the department of the Rhone and Loire, in Burgundy, Auvergne, and Franche Compté. The mines in the Lyonnois, and those at Forez, are among the most important: they are situated in a valley extending from the Rhone to the Loire, in a direction from north-east to south-west, between two chains of primitive mountains, occupying in length a space of six or seven leagues, from Bive-de-Gier to Firmine. In one part of the valley, in the neighbourhood of St Etienne, the strata are nearly horizontal, and the medium thickness of the coal stratum is from three to six feet; near the Loire, there are from 15 to 20 of these strata. The strata at Rive-de-Gier are almost vertical; their thickness is very unequal; sometimes amounting to upwards of forty feet, and seldom less than three feet: the quantity of course is immense, and the quality excellent. In the neighbourhood of Rive-de-Gier, forty mines are generally at work; and in one year, they produced 1,600,000 quintals of coal. As Liege no longer belongs to France, it is not necessary to notice its extensive and valuable mines of coal in this place.

In French Hainault, there are some coal mines at the villages of Fresne, Conde, Augin, &c. which have been wrought for a considerable length of time: there are also mines in the Bourbonnois, Boulonnois, Nivernois, where coal is found within three feet of the surface; at Carmeux; between Beaune and Autun in the department of the Cote D'Or; in several places in Anjou; in Brittany, near Chapelle; Montrellois, and Niort; at Livry in Lower Normandy; and in the neighbourhood of Paris.

Buffon estimated the coal mines which were constantly wrought in France, in his time, at 400; and added that 200 more were capable of being wrought. In 1798, Lefebre published a report of the different coal mines in France; the substance of which we shall give, though of course it includes the mines in those departments, particularly those formed out of the bishopric of Liege, which no longer belong to France.

State of the coal mines in 1798.

From this report it appears, that coal was actually wrought in 47 departments of the empire; that indications of its occurrence had been traced in 16 others; that the yearly produce of the mines of 34 departments had been fairly estimated at 77,600,000 quintals; that if 3,880,000 quintals were to be allowed for the undetermined departments, the total number of quintals would be 81,700,000, which, if converted into money on the coal grounds, would fetch 38,280,000 francs; and that more than 60,000 individuals earned their subsistence at the coaleries, independently of those who were engaged in the carriage and exportation of the commodity.

Of the mines in 1814.

In the annual exposé of the French government for the year 1814, (the first year after Louis XVIII. ascended the throne,) a very flattering picture is drawn of the state of the mines in France; for it was the policy as well as the interest of all the various rulers during the revolutionary æra of that kingdom, to pay particular interest to the working of the mines; and, for that purpose, all the scientific talents, experience, and skill, which could possibly be brought to bear on their management, was, if the expression may be allowed, put in requisition. According to this exposé, which of course must be understood as applying exclusively to France proper, there were, in 1814, 478 mines of different kinds actually working, which employed 17,000 men, and produced a raw material of the value of 26,800,000 francs, and a revenue to the state of 251,000 francs. From the small number of men employed, as well as from the estimate of the value of the raw material, as well as the expression *raw material* itself, this statement must be regarded as not including coal mines, but only mines of the different metals found in France.

Je

Jet is found in the departments of the Aube, the Garde, and the Ardeche; but principally in the neighbourhood of three villages, in the department of the Aube, in the south-west of Languedoc. It is in beds like coal, but not continuous, and is sometimes rendered impure by a mixture of pyrites. It is for the most part met with in a kind of rusty earth, of an ash colour, and sometimes occurs in masses of the weight of 50lbs. about 5 or 6 toises under the surface of the ground. It has been manufactured from time immemorial, in the three villages alluded to, into rosaries, crosses, buttons for black dresses, &c. being an article of great consumption, chiefly in Spain. In 1786, it employed more than 1200 workmen, and the annual supply of the mineral was computed at 1000 quintals. Besides exports to Germany, Italy, and the Levant, Spain imported these jet manufactures to the annual amount of 180,000 livres. Latterly, however, the mines in France seem to have yielded a diminished supply, as jet was imported from Spain for the manufactures. Solid bitumen, or asphaltum, is obtained chiefly in the departments of the Ain and the Lower Rhine; glutinous bitumen, called pisalphaltus in the department of the Puy de Dome; liquid bitumen, called naphtha and petroleum, in Auvergne, (as has already been noticed,) and in the departments of the Herault, and the Lower Pyrenees. Rosin is procured along the banks of the Rhone from Seisal to Fort Ecluse. Alum is found in considerable quantities in the department of the Aveyron. In the province of Berry, ochre, which is used for melting of metals, and in dyeing. Beside the extensive morasses of peat earth along the Somme, and Essone, which seem to have been used for fuel at an early period, there are many other situations, particularly in the north-western departments of France, where this combustible substance is found in greater or less abundance. Within these few years, in consequence of the increasing scarcity of fuel, the attention of the government, as well as of the public, has been called to the state of the turbaries in various parts of the country. Turquoises, scarcely inferior to those of the East, are among the fossil productions of the mountains of the Rouergue, already frequently mentioned: the principal mine is at Simoze. The remains of the species of animal, of which the teeth tinged by copper afford the turquois stone, are found in the department of the Ain. Vitriol, ochres, sulphur, and excellent argil for potteries, are also found in these mountains. Indeed all sorts of earths and sands used in manufactures, as kaolin or porcelain earth, arenaceous quartz, puzzolane, &c. abound in France. Besides the quarries of freestone in the immediate neighbourhood of Paris, there are many others in the kingdom, particularly near Strasburg, towards Saverne, and along the Rhine. These quarries afford hard and solid stones of a surprising size, some being 24 feet long and 6 feet broad; and quarries of a kind of jasper near Salins in Franche Compté, some blocks from which are so large as to be capable of making columns of from 12 to 15 feet high. The marble quarries of the Pyrenees have been already mentioned.

The salt springs at Salins in Franche Compté, about six leagues south from Besançon, and as many east from Dole, demand our notice in this place. The highest hills which surround Salins are of primitive limestone, which is very hard, mixed with clay, and has a testaceous fracture, but contains no shells. Contiguous to these hills are others, composed of limestone of secondary formation, and abounding with shells. In this secondary limestone are found masses and thin layers of gypsum, which is quarried in different places. There are three distinct salt springs, the strongest of which contains 23 per cent. of salt, and the weakest only one. As not only the quantity, but also the strength of these sources, is increased, very soon after rain, it is probable that they proceed from some natural magazine of rock salt in the neighbourhood. Such are the mineralogical circumstances connected with these springs, as given by Hassenfratz, in his "Observations on the Salt Springs of Salins." With respect to the economical circumstances relating to them, we may observe, that the Great Salt-work, as it is called, is a strong place by itself in the middle of the town, surrounded with thick walls, round and adjoining to which are buildings for the wheel-works, cranes, &c. which serve to raise the waters, and for the furnaces, &c. employed in the manufacture. In other places are three great stone reservoirs, which together hold above 25,000 hogsheads of water: there is also a fourth cistern in the ground, which holds above 15,000 hogsheads.

The whole extent of the subterranean caves is about 400 feet in length, by 50 or 60 in breadth; the descent is by 61 steps. At the bottom of this cave, there issue from the same rock, within the space of 14 feet, six springs of salt, and two of fresh water. In another part of the cave are six or seven springs of salt water, along with ten or twelve of fresh water: the waters, of course, are kept quite separate. The salt water is collected in a bason, whence it is raised by wooden pails, linked together about a great wheel, which is turned by a horse. These pails are filled in the bason; and whilst some are filling, the others empty themselves into another bason that stands higher, and out of which the water runs into the stone reservoirs. The different springs have different degrees of saltness. If 1 cwt. of water does not produce at least 18 or 20 lib. of salt, the profit will not answer the expence. The overseers of the springs try the strength of the waters once a week, that, upon their report, those who mix them may do it in a due proportion, according to their respective degrees of saltness. In the evaporating process, there is nothing that requires notice. The surface, or uppermost part of the salt, which, for its whiteness, brightness, and strength, is called *sel trié*, is sent to Switzerland in casks, and sold at a moderate price; the remainder is moulded into cakes of three or four pounds weight. The salt is manufactured at Monter and Arq, as well as at Salins. There are also salt springs at Dieuze and Chateau-Salins, in the province of Lorraine, and salt refineries at Moyenvie, in the district of the Three Bishoprics, as it is called.

Sea salt.

Sea salt is made in great abundance on the coast of France, particularly on the coasts of Brittany, Saintonge, Aunis, Normandy, Poitou, and Languedoc. The salt marshes of Saintonge and Aunis produce the best salt in Europe. In the department of the Channel, salt is prepared from sea-sand on a very extensive and beneficial plan.

Mineral waters.

The principal mineral waters in France are those of Aix, Bagneres, and Barege. The waters of Aix in Provence must have been known to the Romans, as the name of the town is derived from *Aqua Sextea*, from the baths established in it by C. Sextius Calvinius. The source of the baths, however, was lost, till the beginning of the last century, when it was discovered in digging for the foundation of a house, just without the city wall. The temperature of the water is about the same as that of the Queen's bath at Bath; its contents similar to those of Aix la Chapelle, principally sulphur, carbonate of lime, and muriate of soda. Bagneres, in the eastern part of Guienne, derives its name from its baths, which were frequented by the Romans. The hottest spring raises the mercury in Fahrenheit's thermometer to 123°, while the most moderate causes it to ascend only to 86. Two are exactly equal in heat to that of the human body; ten are below it, and eighteen are above it. The waters of the Queen's bath * are strongly purgative; those of Salut and Le Pré, diuretic and cooling. The degree of heat in Salut is 88½. Bareges is situated in a frightful chasm of a valley, shaded on both sides by rude, barren mountains, and the Baston, a foaming torrent, filling the hollow. The situation is such, that the inhabitants dare not stay here during the winter, but remove all their furniture, and even their doors and windows, to such houses as are most out of the reach of mischief from the floods and avalanches. The mineral waters issue out of a hill in the centre of the village, and are distributed into three baths: they are strongly sulphureous, and consequently very fetid. Their degree of heat is from 80 to 112¾: they are greasy to the touch, and tinge silver black. The waters of St Sauveur, near Luz, are not so hot as those of Bareges, but their taste is still more nauseous. There are other mineral waters at Cauterets, in the midst of beautiful scenery. The hottest spring raises the mercury to 118°; in the coolest, it falls to 69°. Bagneres de Luchon may also be mentioned: it is a small town on the river Neste, completely hemmed in by lofty mountains on the borders of Catalonia. The baths are at a small distance from the town, and near the springs, which issue out of a rock, and are three in number, varying materially in their degrees of heat, but all tepid. One of them is separated by a plank from a copious stream, which furnishes the coldest and purest water in the valley. Their streams are suffered to unite soon afterwards, to fill the tepid baths. The other mineral waters of any note in France, are those of Forges, Vichi, Bourbonne, Balaruc, and Plombieres.

Natural curiosities.

La Crau.

Of the natural curiosities in France, we shall principally confine our attention to those which are interesting from their connection with its physical geography. In this point of view, the plain of La Crau claims our first notice. It is situated on the east side of the Rhone, between Salon and Arles; its form is triangular; it covers an area of about 20 square leagues, or 136,780 English acres. This area is covered entirely with quartz of gravel, some of the size of a man's head, but of all sizes less, and the shingle of the sea shore is not more barren of soil. The basis of the whole plain consists of horizontal layers of pudding stone; and as, on examination, the stones on the plain have been ascertained to be exactly of the same kind, there can be little doubt that the vast body of gravel spread over this singular plain has originated from the destruction of layers of the same rock, which may perhaps have risen a great height above what is now the surface. This is the opinion of Saussure, and is more probable than the suppositions, that the gravel has been brought down by the Durance from the Alps of Dauphiny; that the Rhone has formed it; or that it is the work of the sea. This plain was known to the ancients by the names of the Campus Lapidius, or Campus Herculeus. The origin of the first name is sufficiently obvious; the latter was derived from its having been the reputed scene where Hercules, fighting with the sons of Neptune, and being in want of weapons, was supplied from heaven with a shower of stones.

Caves.

There are some singular caves in France, particularly that in Franche Compté, near the village of Beaume, and those of Roquefort; the former is remarkable from its containing a glacier. This cave is at the bottom of a small valley, in the middle of a thick forest. The mouth is 45 feet wide, and is level with the valley. After a long and steep descent, there is a hall 100 feet high, and from this a passage leads to the chamber containing the glacier, the descent to which is by a ladder of 40 feet. In this cavern are stalactites of solid ice, which are in some parts nearly joined by pillars of the same material, rising from a magnificent pedestal on the floor. Reaumur's thermometer, which on the outside of the cave was at 20½ degrees, fell within it to 1¾. With respect to the caves of Roquefort, the air issues from among the fragments of a calcareous mountain. In the month of October, the thermometer of Reaumur descended, in these caves, to 5½°, while it stood at 13° in the open air; and Chaptal, on the 21st of August 1787, with a good thermometer, which stood at 23° in the shade in the open air, found the temperature of a rapid current of air in one of the caves to be 4°. He was informed that the thermometer had been seen, in that exposition, as low as 2° above zero. The hotter the external air, the cooler the caves are found to be, because the current is then stronger. These caves are used in the manufacture of a peculiar and highly esteemed cheese.

Vaucluse.

The fountain of Vaucluse, immortalised by Petrarch, is not uninteresting to the naturalist. At the termination of the valley of Vaucluse, is an immense perpendicular rock, measuring 600 feet in height from its base; within this rock is the cavern, in which rises the fountain of Vaucluse. The entrance to the cavern is 60 feet in height; before it rises an immense rock, which quite conceals it: through this rock the water filters, gushing out at its base in innumerable little streams. Such is the ordinary state of the fountain; but when, in the spring, the snows of the mountains melt, the water rises above the rock, and forms an immense cascade. In the territory of Meyrargues, in the diocese of Aix, is a spring called the fountain of La Foux, which has the same periodical risings as the fountain of Vaucluse, but it is little known.

In the department of Ardeche are several natural curiosities; the bridge of rock, under which the river of Ardeche passes; the grottos of Vallon; the gulf of Goule; with many singular basaltic columns, &c.

Botany.

II. In describing the *botany* of France, we shall be principally indebted to the sketch of it given by Mr Aikin.

Notwithstanding the pains that have hitherto been bestowed by French naturalists in illustrating the Flora of their native country, it still remains in an imperfect state. Particular districts, as the environs of Montpelier, Lyons, and Paris, have been surveyed with considerable accuracy; but many chasms must yet be filled, before a comprehensive history can be made out of the vegetable productions of France. So great, indeed, is its extent, and so various its climate, that probably more than half the European species of plants may be found within its boundaries. The bleak shores of the north; the fertile plains on the Belgian frontier; the rich vales of the Loire, the Rhine, and Garonne; the towering heights of Auvergne; the exterior ridges of the Alps and Pyrenees; the sunny exposure of the Mediterranean coast; offer such striking differences of soil and temperature, as evince at once a most abundant catalogue of indigenous plants. That country which produces in full and equal perfection, wheat and apples, maise and grapes, oranges and olives, the oak and the myrtle, must doubtless exceed all other European countries of equal extent, in the variety and richness of its vegetable treasures. The southern and eastern provinces of France being those which have been the most carefully explored, as well as containing the most interesting plants, are chiefly referred to in the following lists.

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* So called from the celebrated Queen of Navarre, who here lays the scene of her Tales.

Compound flowers.

The species belonging to the large class of compound flowers, including nearly the whole of the class *Syngenesia* of Linnæus, are very numerous. Of these, several are introduced at present into our flower-gardens; such are *Echinops sphærocephalus*, globe thistle; *Onopordon Illyricum*, woolly thistle; *Carlina corymbosa*, *racemosa*, and *lanata*, all three species of the Carline thistle, and natives of Provence; *Atractylis cancellata*, distaff thistle; several species of *Centaurea*, among others *C. benedicta*, blessed thistle; *Santolina incana*, lavender cotton; *Artemisia rupestris*, mountain southernwood; and *A. abrotanum*, common southernwood; both of them plentiful on the rocks of Dauphiny and Provence. *Tussilago* and *Cacalia alpina*, alpine coltsfoot, and cacalia, abounding on the mountainous frontiers of Savoy and Piedmont; *Catananche cærulea* and *lutea*, blue and yellow lion's foot; *Aster alpinus* and *amellus*, Michaelmas daisy. A few esculent vegetables that grow wild in Languedoc and Provence, but are cultivated in our kitchen-gardens, arrange themselves under this class; for instance, *Cynara scolymus*, artichoke; *Tragopogon porrifolium*, salsafy; and *Scorzonera Hispanica*, scorzonera. Two or three are used in medicine, such as *Tanacetum balsamita*, costmary; *Arnica montana*, leopard's bane; *Anthemis pyrethrum*, pellitery of Spain, found in the neighbourhood of Montpellier.

The cucumber, the melon, the gourd, and other kindred genera, though cultivated largely, and with great ease, in the south of France, are yet natives of hotter climates: only one of this natural family, the *Momordica elaterium*, squirting cucumber, properly belongs to the French flora: it occurs in a truly wild state, on low loose rocks, in Provence and Languedoc.

ingent ants.

Of the ringent or galiated plants, numerous species are natives of France, not many of which, however, have found their way into English gardens. The following are almost the whole that are in any request for their beauty, or use, all of which are natives of Languedoc, Provence, or Dauphiny. *Acanthus spinosus* and *mollis*, prickly and smooth Acanthus; *Antirrhinum Monspessulanum*, Montpellier snap-dragon; *Pedicularis flammea* and *incarnata*, lousewort; *Origanum Creticum*, cretan origany; *Melissa officinalis*, baum; *Hyssopus officinalis*, garden hyssop; *Lavandula stæchas*, spike lavender; *Rosmarinus officinalis*, rosemary; and *Salvia officinalis*, garden sage.

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The nearer, in general, any country is situated to the tropics, the greater is the abundance and beauty of the bulbiferous or liliaceous plants that inhabit it. The south of France is particularly rich in these splendid and fragrant vegetables, several of which have been naturalized in our gardens, and constitute their principal ornament. Of the genus *Allium*, garlic, no less than 36 species are natives of France, several of which have been admitted, for their beauty, into English flower gardens; of these the *A. Monspessulanum*, Montpellier garlic, is perhaps the chief. The large branched asphodel, *Asphodelus ramosus*, a flower of great beauty and poetic fame, is by no means uncommon in Provence. *Hemerocallis fulva*, tawny day lily; *Hyacinthus botryoides*, clustered hyacinth; *Ornithogalum pyramidale*, spiked star of Bethlem, are all found in the Mediterranean provinces of France, as are also *Lilium bulbiferum*, *pomponium*, and *martagon*, the orange, pompadore, and martagon lilies; *Erythronium dens canis*, dog's tooth violet; *Bulbocodium vernum*, vernal bulbocodium; *Veratrum album*, white hellebore; *Narcissus poeticus*, and *jonquilla*, narcissus and jonquil. The shore of Hieres is adorned by the *Pancratium maritimum*, sea daffodil, growing luxuriantly on the very beach.

Tuberous.

Allied to the bulbiferous, are the tuberous rooted plants, with sword-shaped leaves, several species of which are found in France. The most beautiful and worthy of notice, are *Gladiolus communis*, corn flag, abundant in the cultivated lands of the middle and southern provinces; the *Iris Germanica*, large purple fleur de lis, in Alsace and on the German frontier; and *Iris pumila*, and *maritima*, dwarf and sea fleur de lis, two elegant little plants, that are occasionally met with in Provence and Languedoc.

Papilionaceous.

Of the papilionaceous plants that are natives of this country, several deserve notice for their use or ornament. *Lathyrus tuberosus*, a vegetable of the pea kind, grows wild in Alsace, and is cultivated in many parts of France, for its large, esculent, tuberous roots; *Lupinus varius*, the great lupin, varying with blue, white, or flesh-coloured blossoms; and *Cicer arietinum*, chick pea, are met with in the southern provinces, growing spontaneously, but are more frequently cultivated in large fields, as food both for cattle and man. In England, the former is considered merely as an ornamental plant, and is found in every flower garden. *Trigonella fœnumgræcum*, fenugreek, esteemed for its medicinal virtues; and *Astragalus tragacantha*, tragacanth vetch, so named from the gum it yields, are both natives of Provence and the vicinity of Montpellier. Many of our most ornamental shrubs belong to this class, such as *Cytisus laburnum*, great laburnum; *C. nigricans*, black cytisus; *Colutea arborescens*, bladder senna; *Anagyris fœtida*, stinking bean, trefoil; and *Spartium junceum*, Spanish broom.

Several succulent plants of the same natural class with the *Sedum*, are found on the dry rocks on the Spanish and Swiss frontiers, of which a few have been introduced into our gardens, viz. *Sedum anacampseros*, and *villosum*, ever-green arpine, and hairy sedum; *Sempervivum globiferum*, and *arachnoideum*, hen and chicken sedum, and cobweb sedum.

Pentandria.

The class *Pentandria* of Linnæus contains several well known plants that occur native in France, some of which have been introduced into our gardens and shrubberies; such are *Primula villosa*, and *auricula*, hairy primrose, and auricula; *Androsace maxima*, and *carnea*, greater and flesh-coloured androsace, all found wild on the mountains of Provence; *Lonicera cærulea*, blue-berried honeysuckle; *Lycium Europæum*, box thorn; *Nerium oleander*, rosebay oleander; *Campanula grandiflora*, and *speculum*, great-flowered campanula, and Venus' looking glass; *Rhamnus paliurus*, and *alaternus*, Christ's thorn, and alaternus; *Tamarix Gallica*, and *Germanica*, German and French tamarisk. Others of this class deserve notice for their use in various arts, and in medicine, as *Pistachia terebinthus*, the turpentine tree; *P. lentiscus*, mastic tree; *Celtis australis*, nettle tree; *Rhamnus infectorius*, the berries of which are used in dyeing, by the name of French berries, or *graines d'Avignon*; *Anchusa tinctoria*, alkanet, another dyeing drug; *Rhus cotinus*, and *coriarea*, common and Venetian sumach, the most powerful vegetable astringents, and largely applied to leather dressing and dyeing; *Salsola soda*, glasswort, a plant growing on the shore of the Mediterranean, from which the barilla of commerce is prepared. Some esculent plants also belong to this class, which, if not strictly natives of France, have at least been long naturalized to the soil and climate; these are *Ceratonia siliqua*, carob-tree; *Pistachia Narbonensis*, pistachia nut tree; *Rhamnus zizyphus*, jujube tree.

Decandria.

But few species of the French flora need be mentioned under the class *Decandria*. The fraxinella, *Dictamnus albus*; the yellow and Narbonne flax, *Linum flavum*, and *Narbonense*; the sweet William, Deptford pink, and carnation, *Dianthus barbatus, armeria*, and *caryophyllus*; the ferruginous rhododendron, *R. ferrugineum*; and the strawberry saxifrage, *Saxifraga cotyledon*, are adopted into our flower gardens; the rue, *ruta graveolens*; and storax rue, *Styrax officinalis*, the former a native, the other naturalized at Hieres, are used in medicine.

Polyandria and Icosandria.

Many of the most beautiful plants of the classes *Polyandria* and *Icosandria*, are to be met with wild in France: such are *Chelidonium corniculatum*, scarlet horned poppy; *Pæonia officinalis*, and *tenuifolius*, common and narrow leaved peony; *Ranunculus aconitifolius*, mountain ranunculus; *Adonis autumnalis, æstivalis*, and *vernalis*, pheasant eye; *Thalictrum aquilegifolium*, feathered columbine; *Aquilegia alpina*, mountain columbine; *Nigella damascena*, and *arvensis*, fennel flower; *Helleborus niger*, and *hyemalis*, Christmas rose, and winter aconite; *Anemone alpina, hortensis* and *hepatica*, alpine and scarlet anemone, and hepatica; *Delphinium elatum*, bee larkspur; *Aconitum napellus*, monkshood. Several trees and shrubs, both ornamental and useful, also arrange themselves under one or other of these classes. *Myrtus communis*, the broad leaved myrtle, grows with great luxuriance along the whole of the Mediterranean coast. *Capparis spinosa*, the caper bush; *Cistus laurifolius*, and *Monspeliensis*, the laurel-leaved and Montpellier cistus, three low shrubs of exquisite beauty, hang from the summits, or cluster round the sides, of the low rocks about Toulon and Montpellier. In the same vicinity also, are found *Rosa gallica*, the Provence rose; *Mespilus pyracantha*, the pyracantha; and *Punica granatum*, the pomegranate tree.

Trees and shrubs.

A few trees and shrubs remain to be mentioned, which will be more conveniently taken together than separated into their botanical classes. These are *Quercus ægilops*, and *Cerris*, the greater and less prickly-cupped oak, two very fine species that are found in plenty about Paris and Fontainebleau; *Quercus coccifera, Suber*, and *Ilex*, the kermes oak, cork tree, and evergreen flax, growing chiefly in the southern provinces; *Juniperus sabina, Oxycedrus*, and *Phœnicea*, the savine, the brown and yellow berried juniper; *Osyris alba*, poet's cassia; *Phillyrea latifolia*, and *angustifolia*, broad and narrow leaved phillyrea; and *Erica arborea*, tree heath; all of them natives of Dauphiné, Provence, and Languedoc.

Rare plants in the Pyrenees.

Among the rare plants which the Pyrenees afford, may be noticed the following: *Ranunculus glacialis*; *R. parnassifolius*; *Androsace aretia*, (probably *Carnea* of Linnæus); *Daphne calycina*; *Saxifraga longifolia*, and *Arenaria fruticulosa*.

Plants in the meadows.

The plants found naturally growing on the best meadows in France, are exactly the same as those which grow in the best meadows of Great Britain, viz. *Lathyrus pratensis*; *Achillea millifolium*; *Trifolium pratense*; *Trifolium repens*; *Plantago lanceolata*; *medicago lupulina*, this is indigenous over the whole kingdom of France; *Medicago Arabica polymorpha*; *Lotus corniculatus*; *Poterium sanguisorba*. To these may be added another plant, found amply in the richest meadows in the south of France, and, what is remarkable, indigenous to England on poor land, the *Cicoryum intybus*.

The botany of the singular desert of La Crau may be cursorily noticed; on it the *Absinthium* and *Lavender* grow, but so low and poor, as scarcely to be recognized. There are also the *Centaurea calycitrapa* and *solstitialis*, and *Eryngium*. Where this desert is watered, however, clover, chicory, rib-grass, and avena elatior flourish.

Zoology.

III. The *zoology* of France, so far as it regards the domesticated animals, will be afterwards given; and on the other animals we must be very brief, confining ourselves, indeed, to the notice only of a very few. Bears are by no means uncommon in the vicinity of the Pyrenees, and Alps of Dauphiny. There are both sorts, carnivorous and vegetable eaters: the latter are more mischievous than the former, though not so dreadful, coming down in the night and eating the corn, particularly buck-wheat and maize; and they are so nice in choosing the sweetest ears of the latter, that they trample and spoil infinitely more than they eat. The carnivorous bears wage war against the cattle and sheep: they attack the former by leaping on their backs, when they force the head to the ground, and thrust their paws into the body in the violence of a dreadful hug. There are many hunting days every year for destroying them, several parishes joining for that purpose. A bear never ventures to attack a wolf; but several wolves together, when hungry, will attack and kill a bear. Wolves are very common in different parts of France, and very destructive to the sheep. The wild boar is also found in some parts of this kingdom. The ibex, rock-goat, or bouquetin (or bouctain, from *bouc*, a goat, because they resemble goats), are found in the Pyrenees, and in the Alps of Dauphiny. They are of a grey colour, with very long and strong horns. On the mountains of Volni, near Rochecourte, in the mountains of Dauphiny, the chamois is found, of the antelope class. The *Becca-fico*, and the *Cicala*, of the Italians, are not uncommon in the southern provinces of France. The *Cicala* never ceases making its peculiar and disagreeable noise, from sun-rise to sun-set. The noise it makes is said not to proceed from its throat, but from two membranes underneath the wings towards the tail, which it fills with wind, and blows like bellows. It is certain, if the animal be quiet, on touching the tail it immediately begins making its noise again. In this part of France, scorpions also are not uncommon. Of serpents there are 11 species found in France. Among the animals almost peculiar to this country, may be mentioned the *Vespertilio serotina, Pipistrella, Barbastella*, the *Otis tetrax*, the *Charadrius luteus*, &c.

CHAP. IV.

Agriculture of France.

SECT. I.—*State of Landed Property, and Condition of the Agricultural Population before and since the Revolution—Distribution of the Soil—Rent—Price—Inclosures—Implements—Roads—Rotation of Crops—Crops cultivated—Harvest—Thrashing and treading out the Corn—Manures—Irrigation.*

BEFORE the Revolution, agriculture in France was nearly in the same state in which it is still in almost every country in continental Europe. About two-fifths of the land susceptible of cultivation, were in what is termed culture and pasturage, and produced, on an average, about one-half of what good culture, on the like quantity of the same soil, would have produced.

If France has been in any respect benefited by the Revolution—if she can claim any permanent and general good arising from it as a compensation and atonement for the physical and moral evils she has suffered and inflicted—that benefit and good must be looked for in the state of her landed property, and in the condition of her agricultural population.

State of landed property before the Revolution.

Before the Revolution, the land in France was held by various tenures, almost all of which were decidedly and extremely unfavourable to agriculture. The manor rents of the clergy have been variously estimated. Condorcet, in his Life of Turgot, gives it as his opinion, that the clergy enjoyed near a fifth part of the property of the kingdom. Neckar calculated their revenue at 130,000,000 livres; but it is probable that their manor rents may fairly be estimated to have amounted to about 120 millions of livres, or £4,800,000 sterling, exclusive of their tithes, which may be rated at about £3,600,000 sterling. The domains of the crown and of the princes of the blood, rented for about £1,200,000 sterling; the feudal and honorary dues paid to the nobility, with *corvées*, militia, &c. amounted at least to £5,000,000 sterling. Besides, the government drew from the produce of agriculture the sum of £8,000,000 sterling. In short, it has been calculated, that, exclusive of the rents of land paid to the lay-proprietors, and of the duties of excise, consumption, and the like, the produce of the soil was charged annually with upwards of £21,000,000 sterling.

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But agriculture laboured under disadvantages still more discouraging and oppressive, previously to the Revolution; to understand and estimate which, it will be proper to consider the different modes of occupying land which then existed, some of which, however, as we shall afterwards see, still remain. In the first place, there were the small properties of the peasants. These were to be found every where to a degree of which we have no conception in England, and which we should not have expected in the midst of the enormous possessions, and the oppressive privileges, of the nobility and the clergy. Even in those provinces where other tenures prevailed, they were to be found; but principally in Languedoc; Quercy, which now forms the department of Lot; the whole district of the Pyrenees, Bearn, Gascony, part of Guienne, Alsace, Flanders, and Lorraine. The condition of the peasantry, who possessed these small properties, varied much in different parts of the kingdom. In Flanders, Alsace, on the Garonne, and more particularly in Bearne, they were in comfortable circumstances, and might rather be called farmers than cottagers; and in Lower Brittany many of them were rich; but this character could by no means be applied to them generally. In fact, the minute division of property had produced the effects which might be expected from it; and poverty and misery were too visible, especially in Lorraine, and the parts of Champagne which are contiguous to it.

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ey rent.

The second mode of possessing land, was by a money rent. This, before the Revolution, was the general practice in Picardy, Normandy, part of Flanders, Artois, Isle of France, and the Pays de Beauce. It also existed in some of the southern districts of France, particularly in Bearn, and about Navareens, a town in the department of the Lower Pyrenees. These tenures were also found in other parts of France, scattered among those which were different and predominant; but, upon a moderate estimate, before the Revolution, they did not exist in more than a sixth or a seventh of the kingdom.

Feudal tenures.

Feudal tenures were the third mode of occupying land. They abounded most in Brittany, Limosin, Berry, La Manche, &c. but they were scattered in a greater or less degree through the whole kingdom. These feudal tenures were fiefs granted by the seigneurs of the parishes, under a reservation of fines, quit rents, forfeitures, services, &c. As they formed the most oppressive evil under which agriculture laboured previously to the Revolution, and from which that event must certainly be allowed the merit of having freed it, it may be proper to notice some of them. Even to enumerate the whole of these oppressions would far exceed our limits; and indeed, the English language does not supply terms by which many of them can be expressed.

Among the more mild and tolerable of these feudal tenures, may be mentioned the obligation the tenant was under, of grinding his corn at the mills of the seigneur only; of pressing his grapes at his press only; of baking his bread in his oven. The peasantry in Brittany were obliged to beat the waters in marshy districts, to keep the frogs silent, in order that the lady of the seigneur, during her lying-in, might not be disturbed by their noise. In short, every petty oppression which could render the lives of the peasantry miserable, or interfere with the operations of agriculture, was authorised by these feudal tenures; though it must be confessed, that, before the Revolution, some of the seigneurs, convinced of their injustice as well as impolicy, forbore to exact them. Nor were the oppressions of the feudal tenures the only ones to which agriculture was exposed. There were numerous edicts for preserving the game, which prohibited weeding and hoeing, lest the young partridges should be disturbed; steeping seed, lest it should injure the game; manuring with night soil, lest the flavour of the partridges should be injured, by feeding on the corn so produced; mowing hay before a certain time, so late as to spoil many crops; and taking away the stubble, which would deprive the birds of shelter. These were oppressions, to which all the tenants of land, as well as those who held under feudal tenures, and even the proprietors of land, in many cases, were exposed. The latter, indeed, were dreadfully tormented by what were called the *Capitainries*, which, as affecting them in some measure, as the feudal tenures affected the farmers, may be noticed under this head. By this term was to be understood, the paramountship of certain districts, granted by the king to princes of the blood, by which they were put in possession of the property of all game, even on lands which did not belong to them, and even on *manors* granted long before to individuals; so that by this paramountship all manorial rights were annihilated. The privileges thus conferred, were most grievous and oppressive; for by game was understood, whole droves of wild boars, and herds of deer not confined, but wandering over the whole country to the destruction of the crops; and if any person presumed to kill them, he was liable to be sent to the gallies. It may easily be conceived, that the minute vexations, as well as the more prominent tyrannies, to which the feudal tenures gave rise, would occasion frequent disputes between the seigneur and his tenants; but the latter preferred submitting to them, rather than appealing to the decision of judges, who were absolutely dependant on the seigneurs.

Corvées. We may here also notice the *corvées*, as one of the taxes peculiarly oppressive and injurious to agriculture, though not confined to the tenure we are now considering. By the *corvées*, individuals were obliged to mend the roads by their personal labour; hence it is evident that this tax must have fallen exclusively on the poor; or if it was performed by those who kept labourers, it must have deprived them of the means of fully attending to their agricultural operations. This tax was not only impolitic, in so much as it placed the repair of the roads under the care of those who were totally destitute of the little skill requisite for such a task, but it was an easy engine of oppression; for, under the pretence that the work might be done without interruption, those who were liable to the *corvee* had it frequently allotted to them at some leagues from their habitations. Besides these *corvées*, which were an oppression to agriculture over the whole of France, there were the military *corvees*, which fell only on the villages lying in the route of the troops; the inhabitants of which were obliged to leave their occupation, however inconvenient and injurious it might be, and repair the roads along which the soldiers were to travel. Such are a few of the oppressions under which agriculture in France laboured, previously to the Revolution, arising either from the feudal tenures, or from the more general operation of the laws and measures of government, the privileges of the nobility and clergy, and the usages of the country.

The fourth mode of occupying land, resembled that which is common in Ireland, and which is there complained of as a great grievance, and as the source of much misery and oppression. Men possessed of some property, hired great tracts of land at a money rent, and relet it in small divisions to *metayers*, who paid half the produce. This mode of occupying land was most common in La Manche, Berry, Poitou, and Angoumois, but it was also met with in other provinces.

Metayers. The last tenure was that of the *metayer*. These, who are a species of farmers that gradually succeeded to the slave cultivatory of ancient times, and who, in Latin, are called *coloni partiarii*, have been so long in disuse in England, that there is no English name for them. They may be generally described, as supplying the labour necessary to cultivate the land, while the proprietor furnished them with the seed, cattle, and instruments of husbandry, and, in short, the whole stock necessary for cultivating the farm. The common agreement was, that the produce should be equally divided between the proprietor and farmer, after setting aside what was necessary for keeping up the stock, which was restored to the proprietor, when the farmer either quitted, or was turned out of his farm.

Before the Revolution, seven-eighths of the lands in France were held under this tenure. It pervaded almost every part of Sologne, Berry, La Manche, Limosin, Anjou, Burgundy, Bourbonnois, Nivernois, Auvergne, &c. and was found in Brittany, Maine, Provence, and all the southern districts. In general, the half of the produce was paid to the proprietor; but in Champagne only a third. There were also other variations: in some parts, the proprietor found half the cattle and seed, and the metayer the labour and implements, besides paying the taxes; the last, in other districts, were partly paid by the proprietor. In Normandy, a singular species of this tenure prevailed, viz. on the farms which the proprietors kept in their own hands.

It is scarcely necessary to point out the miserable state of agriculture, which must exist in a country where the system of metaying prevails. In the first place, it proves a lamentable deficiency of agricultural capital; and, in the second place, it has a manifest tendency to perpetuate this evil, and to keep the tenant in the lowest state of dependence, misery, and poverty. In some parts of France, the metayers were so poor, and consequently so dependent on their landlords, that they were almost every year obliged to borrow from them their bread, before the harvest came round.

Effects of the Revolution on landed property. Such were the tenures of land before the Revolution. Let us now enquire what effects that event has produced on them, and on the condition of the agricultural class in general.

In the first place, the number of small properties have been considerably increased in all parts of France. The national domains, which consisted of the confiscated estates of the church and emigrant nobility, were exposed to sale during the pecuniary distresses of the revolutionary government. For the accommodation of the lowest order of purchasers, they were divided into small portions, and five years were allowed for completing the payment. In consequence of this indulgence, and of the depreciation of assignats, the poorest classes of the peasantry were enabled to become proprietors, possessing from one to ten acres. They support themselves by cultivating these, and by labouring, at the same time, for the neighbouring farmers. The number of small properties has also increased from another cause, since the Revolution. Before that event, it seems to have been the law, or at least the invariable custom, in some parts of France, to divide the landed property among all the children. This local law, or custom, was extended, soon after the Revolution, to the whole kingdom; so that, by the present law of France, land, on the death of a proprietor, is divided, by the law itself, among his children. The deplorable consequences which must ultimately result from this division and subdivision of little properties, in a country like France, already so fully appropriated, need not be pointed out; they are sufficiently obvious. We content ourselves with stating the fact, as illustrating one mode in which the tenure of landed property has been affected by the Revolution.

In the second place, hiring at money rent is much more general since the Revolution; and if France continues quiet, and recovers from the injurious consequences of the Revolution, it may reasonably be expected that this species of tenure will become more and more prevalent.

In the third place, feudal tenures are done away, as well as tythes, game laws, corvées, &c. In some parts, however, the tenants, by their covenants with their landlords, are still bound to perform some services, but by the law, they must be entirely of an agricultural description.

In the fourth place, the two other species of tenure, that is, monopoly, where men of property hired great tracts of land at a money-rent, and relet it in small divisions, and the system of metaying, still exist, though not nearly to such an extent, or in such an oppressive and ruinous form, as before the Revolution. Indeed, when we consider that these species of tenure were the unavoidable and necessary consequences of inadequate agricultural capital, we cannot expect that they should be abolished by the mere operation of law, or by the direct effects of any revolution, however wisely planned and carried into execution. If, however, we find th they gradually die away, which seems to be the case, we may safely and rationally maintain, that the Revolution, besides the direct benefits which it has bestowed on agriculture, by the abolition of feudal tenures, and partial and oppressive taxes, has indirectly proved advantageous to this first of all arts, by placing in the hands of those who pursue it more adequate capital.

Such are the benefits which the Revolution has conferred on the agriculture of France, and which have manifested themselves, notwithstanding the military despotism which, after exhausting and weakening her for the purpose of enslaving the continent of Europe, has at length brought down upon her a just retribution for her too ready acquiescence in its schemes. These, however, are only partial and temporary evils; and we may confidently predict, that when they are passed away, the agriculture of France, which, from her excellent climate and easily worked soil, must always be the staple branch of her national industry, and the principal source from which she must draw her political influence and military power, will be found to have come out from the ordeal purified and refined, and the condition of her agricultural population in every respect greatly ameliorated.

Distribution of the land.

It is not easy to ascertain the distribution of the land in France. According to Mr Young, there are of arable land 70,000,000 acres; under the culture of the vine 5,000,000; in woods 19,850,000; in meadow and rich pasturage 4,000,000 acres; under lucerne, sainfoin, &c. 5,000,000; and the pastures and wastes occupy 27,150,000; thus making a total of 131,000,000 acres. This estimate, however, as far as respects the number of acres under wood, is certainly over-rated, though Mr Young on this point follows the authority of Mr Neckar; for a committee of the first National Assembly stated the whole extent of territory covered with wood at 13,100,691 arpents, of 100 perches of 28 square French feet each; whereas, according to Mr Neckar and Mr Young, it amounted to 22,289,016 arpents. The general occupation of the land in the northern provinces of France, may be conceived, from the following account of the distribution of a small commune. Woods and meadows in the occupation of the proprietor, 250 acres; two farms let, keeping two ploughs each, together eight horses, 300 acres; 10 freeholders, keeping one plough each, together 20 horses, 750 acres; 28 freeholders, keeping no horses, occupying 250 acres; in all, 1550 acres, of which 1300 were arable. These are distributed as follows: under fallow 433, under wheat 433, under oats 433. Those who have no ploughs pay 40 francs (33s. 4d.) per acre to their neighbours for the team labour of the whole course, viz. four ploughings on the fallow, and one ploughing for oats; four loads of dung per acre carted on the fallow, and the harvest carting. Those proprietors who possess no ploughs are labourers, and in general work for the person who performs the ploughing of their land. The number of acres ploughed in this commune annually is 2165, or about 7½ acres per day for 14 ploughs, leaving sufficient time for harrowing, harvest, and the carting of dung.

The rent of land is low in most parts of France. Before the Revolution, the rent of the arable and lucerne land was averaged by Mr Young at 15s. 7d.; of the woods at 12s.; of the vineyards at £3 : 16 : 6; of the meadows at £2 : 3 : 9; and the wastes at 1s. 9d. At present, extremely good land in Normandy may be got for 30s. per acre; 18s. and 20s. are more common. In other districts, it is even very much lower. The price of land of course is proportionally low. Before the Revolution, the average price of all the cultivated land in the kingdom, was estimated by Mr Young at £20 the English acre. In 1814, Mr Birkbeck mentions an estate near Cosne of 1000 acres arable, and 500 wood land, let on lease for nine years for £375 sterling, which might be bought for 22 years' purchase, or £8333. It is proper to add, however, that one-third of the arable land of this farm was poor cold clay, of little value; two-thirds pretty good wheat land; part dry enough for turnips. In 1807, Mr Pinckney states, that the average rents from Paris to Maine were about 15s. the English acre; and the purchase from £15 to £18. The value of lands in the vine districts of France, is much higher, amounting on an average to upwards of £60 per acre, according to some authors; but others rate it only at £41 per acre. **Size of farms.** The size of farms is in general small; few, even in Normandy and the other provinces where agriculture is conducted on the best plan, and with the greatest capital and skill, reaching 300 acres. **Capital.** With respect to the capital employed by the farmers, Mr Young calculated it on an average of the whole kingdom, not to exceed 40s. per acre. In this, however, he was probably much mistaken. At any rate, at present, the average must be much higher. In French Flanders, it is calculated that a farm of about 250 English acres will require a capital of upwards of £1500 sterling, or about £6, 5s. per English acre. In this estimate, the live-stock is supposed to cost £716 : 16 : 8; of which 15 horses at £16 : 13 : 4 each, 14 milch cows at £9 each, and 180 sheep at 17s. 8d. each, form the chief articles. The instruments of husbandry form the next division of this estimate, and amount to £138. Of these the large waggon is rated at upwards of £45; and the lighter waggons, of which there are three at nearly £20; four ploughs at £2, 10s. each, besides a Dutch plough at £2 : 12 : 6; the harrows, all of wood, at 8s. 4d. each. The third branch of the estimate is the servants' wages for 15 months. The number is eight; three ploughmen, one man to take care of the young horses, a shepherd, two women, and a swineherd; their wages, one with another, being £4 : 11 : 8 per annum each. The wages of the labourers are rated at from 8d. to 1s. per day. The maintenance of the 15 plough horses and 10 young horses for 15 months, is estimated at about £150. It is probable that capital to the same amount is required in the other parts of France, where agriculture is well understood, and carried on with spirit and success. In the other districts, where it is far behind, of course the capital will be much less.

Inclosures.

The prevailing opinion, that France is entirely an open country, is very erroneous. It is certainly much less inclosed than England. All Brittany, the western part of Normandy, and the northern part of that province as far as the Seine, most of Anjou and Maine, Lower Poitou, Touraine, Sologne, Berry, Limosin, the Bourbonnois, and a great part of Nivernois, part of Auvergne, and Quercy, are inclosed. The whole district of the Pyrenees is thickly inclosed. This district of country comprehends 11,000 square leagues; so that if the other parts of France that are inclosed be added, they will raise the total to a full half of the kingdom. But though so large a portion is inclosed, the inclosures in general are ill planned, and badly kept; and their value and utility so little understood, that the same rent is given for inclosed and open fields, provided both are arable. Perhaps the province of Bearn exhibits more attention to the proper management of inclosures than most other districts of France. There is not a county in England closer, thicker, or better inclosed; and, what is uncommon in France, the gates and stiles are in good order. Commons are not met with in France, at least not in the same sense in which they occur in England; but common fields abound, and they are cursed with all the mischievous consequences which attend them in England, such as rights of common pasturage commencing on given days when under corn, and throughout the fallow year. There is a great deal of common field land in Picardy, Artois, part of Normandy, the Isle of France, Brie, the Pays de Beauce, and along the whole course of the Loire. In this last district, the farmers are in the practice of making an exchange with the poor, who have the right of common pasturage. This they buy off, assigning an acre or more to every cottage in the parish.

It is a singular circumstance, that some of the poorest and least improved provinces, are precisely those which are best and most generally inclosed: hence it is easy to perceive, that the mere existence of inclosures is not in France, as in England, a proof of the advancing state of agriculture. The chief cause of new inclosures in France, is, that the communities in many parishes, in different parts of the kingdom, and more especially in the vicinity of the Pyrenees, being proprietors of the wastes, sell them to any person who applies for the property, in absolute assignment; in consequence of which, the purchaser has the power of inclosure: whereas, in the waste plains of Brittany, Anjou, Maine, and Guienne, the seigneurs are the sole and absolute proprietors, and they will not sell, but only feu their estates. Hence the waste lands remain unchanged and unimproved. The government of France, before the Revolution, took some measures to enforce or facilitate a general inclosure with respect to some of the provinces, more particularly with regard to Lorraine, in 1764 and 1765; but the popular objections and prejudices against inclosures, had such weight, that at the commencement of the Revolution, strong remonstrances were presented against them, and certainly the proportion of inclosed land has not considerably increased since that event.

Implements.

The agricultural implements in general use in France are very rude and imperfect in principle as well as in construction; the plough in most parts is almost entirely of wood, and scratches and pushes forward the soil, instead of penetrating to any depth, or turning it over. In the vicinity of the Pyrenees, a light imperfect plough, similar to what the Romans used, and drawn by a pair of weak cows, is not uncommon. In the neighbourhood of Toulouse, a better plough is seen, of pretty good construction, to which two strong oxen are yoked, the ploughman driving them by means of a long staff, that answers the double purpose of a goad and a paddle. The use of oxen in the plough is pretty general in France, and they are yoked in a different manner from what is practised in England: A piece of wood, of about 1-6th of the weight of an English yoke, is put across the forehead of the cattle, the extremities of which are neatly hollowed out, so as to fit the mould of the head, and the hollows lined with a piece of woolly sheep skin, to answer the purpose of a soft pad or cushion. This light and easy yoke is braced to the horns with a small thong of leather, to the middle of which the beam of the plough is attached: the animals are thus completely equipped for their labour. It seldom happens that more than two oxen are yoked in a plough. In the north of France, as well as in some of the eastern, western, and middle provinces, horses are more commonly used than oxen; generally two horses, but in some instances three. Besides the plough that is used for the general purposes of agriculture, in several districts, both in the north and south of the kingdom, a little plough called a *binot* is employed, principally for the purposes of fallowing and destroying the weeds. In some respects the *binot* resembles a plough, with a double or scuffler share, and two mould boards, but it has no coulter. In the French Netherlands, where agriculture is carried on in a regular and systematic manner, some farmers have three binots to eight ploughs, some two binots to five ploughs, and some two to four ploughs. Only one ploughman and two horses are employed; the furrow which it makes is from five to six inches in depth. Its operation is different from that of the common plough, since it does not turn over the land, but elevates it into small ridges, by which means the weeds are exposed to the action of the frost and of the dry weather. After the binot, the land is always ploughed for the seed furrows. The harrows, in general use, are equally imperfect in principle and construction with the ploughs, and have always wooden teeth. In most parts of France rollers are unknown, and their use is supplied by a plank on which a boy rides over the land. Their carts and waggons display equal ignorance of mechanical principles, being in general of enormous length; the carts which are used for the carriage of goods, are not above two-thirds so wide, and certainly two-thirds longer than those in England; they travel in large companies, frequently 16, 18, or 20, in a string together, especially in the south-east of France, each drawn by a single horse, with about half a dozen drivers attending them. The *charette*, or cart in common use, consists principally of two parts—the carriage and the body; the carriage part is very simple, being composed of two long shafts of wood, about 20 feet in length, connected together by cross bars, so as to form the bed; on this the boards are laid, as occasion may require: in the same manner, the sides, a front and back may be added at pleasure. The axle and wheels are in the usual place and form. The moveable body is fixed on this carriage; it consists of a similar frame work, of two shafts, connected by cross bars. This body moves upon an axletree, and extending some feet beyond the carriage behind, it is let down with ease to recover its load, while the body, moving on a pivot, or axle, is easily purchased up from before.

Ro

In France, before the Revolution, and even since that event, the construction and repair of the roads is entirely lodged with the government. The great military roads, especially that over the Simplon, are excellent, with respect to the principle on which they are constructed, the materials of which they are formed, and the whole of their execution. But the roads which were not necessary for military purposes have in many places been greatly neglected, although it was stated, in the year 1806, by the minister of finance, that more than thirty-five millions of francs were annually requisite for the reparation of the roads and public works. In 1809, a collection of laws was printed regarding the management of the roads; in which a law passed in the time of the Republic, for establishing the use of broad cylindrical wheels, is strongly enforced. According to this law, the wheels of heavy waggons were to be nine inches three lines broad; and they are allowed to carry only a certain weight, which varies during the five winter and seven summer months. It was also enacted, that in those parts of the kingdom where the roads were paved, the passing upon the pavement should be suspended during those seasons when they were likely to be injured, and the side roads alone should be used. The weight allowed to be carried was not only to vary in winter and summer, but also according to the form of the wheels; and, in order to enforce this law, weighing engines were to be erected, and the owners of carriages exceeding the legal weights were declared liable to severe fines. But these laws have been very partially enforced; so that some of the best roads in France, under the old government, have fallen into complete disrepair. This has been very particularly the case with the famous chausee of Languedoc, which begins at Villeneuve, whence it crosses the whole province. The cross roads have suffered still more than the main roads since the Revolution; and both have suffered more in the atlantic departments, than in any other districts of France. Throughout the whole department of Finisterre, the cross roads are in a most wretched state. The roads, in several respects, differ from the roads in England; they are generally broad, always straight, paved, and planted on both sides with chesnut trees, poplars, walnut, mulberry, and other fruit trees. There are 28 principal roads from Paris to the boundaries of the kingdom. Turnpike gates and tolls have been established since the Revolution, at the distance of five kilometers from each other.

The state of agriculture in any country may generally be pretty well ascertained, from the rotation of crops which is pursued: If these are conducted on good principles the agriculture can scarcely be very bad; on the contrary, if bad rotations are pursued, agriculture has made very trifling advances towards perfection. If we judge of France according to this rule, we shall decide, that, though over by far the greatest part of the kingdom agriculture is in a miserable state, yet in some parts it is well understood and flourishing.

Rotation of
rops on
oam ;

We have already mentioned the divisions of France into districts, according to the nature of the soil; we shall now note the principal rotations pursued in each district. In the district of rich loam, two rotations principally prevail, according to one of which, in Flanders and part of Artois, there is no fallow, but a constant succession of crops. The most approved and productive rotation is found between Valenciennes and Lisle: it consists of wheat, and turnips after it the same year; oats, clover, wheat, hemp, wheat, flax, coleseed, wheat, beans, wheat. In the provinces of Picardy, Isle of France, Normandy, and the other parts of Artois, the usual rotation was not in general so good, consisting of fallow, wheat, and spring corn. In some parts of Normandy, however, fallows are not known; and in other parts, especially between Dieppe and Rouen, where the soil is a deep hazle mould upon chalk, fallow occurs only once in six years; the rotation being fallow, wheat, pease, vetches, flax, or rape seed; wheat, clover, oats. In the rich plain of Alsace, the fields are never fallowed; the fallow crops being potatoes, poppies for oil, pease, maize, vetches, clover, beans, hemp, tobacco, and cabbages. In the Limagne of Auvergne, one of the richest districts of France, fallows are partially used; but the usual rotations, in other respects, are so severe, that only such a soil and climate could bear them; it is not unusual to sow rye after wheat, and wheat after rye. The latter grain is often sown on their best land; and wheat on their worst: a common rotation is barley, rye, hemp, rye: wheat is grown also after beans: two crops in the year are not unusual.

As soon as ever the maize district of France is entered upon, fallows disappear; that grain being cultivated in such a manner as to preclude the necessity of a fallow. In the plain of the Garonne, the usual rotation is maize, wheat; and here also is first found the culture of different species of vetches, which are sown both in September and in the spring; and, together with hemp and maize, assist in banishing fallows. Yet even in this highly favoured district, rye is often grown where wheat might be cultivated with advantage. Turnips are a second crop after wheat and rye. The culture of the white lupin is common here.

in the maize district;

in the heath district;

In the heath district great quantities of buck wheat are grown, and in some parts parsnips: but broom is the great object and source of profit; the common course being broom sown with oats. The broom is fed for three or four years, and then cut; after it wheat is taken, then rye, buck wheat, and oats, or broom. This last is cultivated for fuel, as the district has neither coal nor wood. When the land is exhausted by this mode of cropping, it is pared and burned, abandoned, and by time recovered, that a succession of crops may bring it once more into the same situation.

in Gascony;

In Gascony, the usual rotations are maize, wheat, and turnips; maize, clover cut once, and then ploughed up for maize again; rye, millet, haricots or kidney-beans; maize, rye, millet; and maize, rye, clover.

in the district of the Pyrenees;

In the districts of the Pyrenees, where irrigation is practised with considerable skill, and on an extensive scale, fallow is superseded by the culture of clover, millet, maize, and haricots. Maize, however, is not cultivated in such large quantities as in other parts. Two crops are gained every year; but where irrigation is not practised, the ground is fallowed, and afterwards millet, haricots, or barley sown for forage, before the wheat is put in. In Dauphiny, buck wheat is sown on the wheat stubbles; and, such is the earliness of the climate, that it is frequently in full blossom by the end of August.

in the stony district.

The rotation in the stony district is particularly distinguished, by the introduction of potatoes in some parts of it, as a preparation for wheat. Where this root is not cultivated on a large scale, and as a crop in regular rotation, the common course is fallow, wheat or rye, and barley or oats. In the district of chalk the rotation is in general very bad. In the province of Sologne it is fallow and rye: certainly the very worst and most unprofitable that can be practised on any land. In the district of gravel, especially in the Bourbonnois and Nivernois, the same wretched rotation is pursued. The district of various loams is chiefly distinguished by the introduction of turnips into the rotation; but, as we shall afterwards have occasion to remark, the culture of this valuable root is ill understood in France.

From this account of the most common rotations in various parts of France, it will be seen, that in general they are conducted on very erroneous principles; and that, even where they are good, the climate ought to have the merit rather than the skill of the agriculturist. In the south of France, the climate enables him to take two crops in the season. This advantage is, however, also derived in French Flanders, entirely through the attention and skill of the farmer. The second crops in that district being carrots, turnips, spurry, and yellow clover.

General result.

The following, perhaps, will give a sufficiently precise and clear view of the general rotations practised in France. The arable land, that comprises nearly the whole of the kingdom, with the exception of the vineyards, and a few tracts of mountain, may be divided into five classes, with respect to fertility of soil. The first class bears a crop every year, as in most parts of French Flanders, some parts of Normandy, the Limagne of Auvergne, the neighbourhood of Toulouse, and generally where maize is cultivated, or irrigation employed. The second class, which is rather inferior in point of soil, but is still good land, is cultivated with the intervention of a fallow once in six years, as about Dieppe and Rouen particularly; once in five years, as in some parts of French Flanders, and in a few other districts. The third class of land, of middling quality, which embraces a large portion of the kingdom, is managed on the old plan, of fallow, wheat, oats, or barley. The fourth, still poorer land, is fallow and wheat alternately; and the last class of land, where the soil is in general miserably poor, is cultivated in the round of fallow, rye, rest without grass seeds. As it is probable that the three last classes of soil comprise half the cultivated surface, and as half of them are fallow, it appears that one-fourth of the whole country is lying in a state entirely unproductive. The best husbandry in France, then, is in the south and in the north; in the former, the goodness of the climate enables the agriculturist to raise maize and wheat alternately, and to have second crops of millet, clover, lupins, &c.; and in the north, the skill of the agriculturist has, in a great measure, banished fallow. On the whole, so far as respects rotation of crops, French agriculture cannot be much praised; and it will be seen, that the management of the principal crops is in general not better conducted than the rotation. Before, however, we proceed to notice the culture of particular crops, it is proper to mention, that the application of land to the crops best suited to it is not well understood. Even in many parts of Normandy, land that would bear heavy crops of wheat is not unfrequently sown with barley; and rye in many parts is sown, where the soil is admirably adapted for wheat. It not unfrequently happens, too, that rye is sown along with wheat; the consequence of which is, that, as the former ripens three weeks or a month sooner than the wheat, when the latter is reaped, almost the whole of the former is shed and lost.

Wheat.

Different kinds of wheat are grown in France; the principal of which are the bearded wheat, various species of the common winter wheat, and spring wheat. What in England is called hedge wheat, where it is of comparatively late introduction, has been long known in the north of France, particularly at Calais, Lisle, and Dunkirk; it is known there by the name of pullet wheat (*blè pullet*), or white wheat (*blanc blè*), and it is regarded as wheat of the first quality. One of the best kinds of spring or summer wheat known in France, is called *blè tremois*; the real summer wheat, *triticum æstivum*,—it is sown with success so late as the end of May, and yields a large increase. The straw, too, is excellent fodder. The produce of wheat in France per acre is small: Even in the best cultivated districts, and on the best soil, it cannot be averaged at more than 18 or 20 bushels per English acre. In most places it is reaped; this operation being performed, like the other agricultural operations in France, chiefly by women. In other districts, however, it is mown: the whole process of harvesting is very carelessly performed. In a good year, in Picardy, 40 sheaves are calculated to produce a septier of wheat of 240 lb. The principal wheat districts of France, are French Flanders, Artois, Picardy, parts of Normandy, the Limagne of Auvergne, part of Alsace, &c. Beauce, a province which lies between the isle of France, Bloisois, and Orleannois, and which now forms the department of the Eure and Loire, is so extremely fertile of wheat as to be called the Granary of Paris. The wheat of Narbonne is in high repute for seed.

Barley.

Barley is not extensively or judiciously cultivated in France. There are two sorts: the one which the French call square barley, or barley of autumn, because they sow it in that season; the other is called spring barley: This is the common sort sown in France; they begin to sow it towards the end of April. This grain is the common food in many parts; either made into bread by itself, or mixed with wheat flour. It is also made into peeled barley: the best peeled barley comes from Vitry-le-François, a considerable town in the department of Marne. Good peeled barley is also made at Charenton, near Paris. Respecting the culture of oats there is nothing that calls for notice. Rye, as it may have been observed from the rotations which have been specified, is very generally cultivated, principally for its grain, but in some places as green food. In the latter way, the ridges of the wheat stubble are split down, as early as possible after the crop is off the ground, and rye is sown, which in April or May is cut for the cattle; and, if the weather proves favourable, in some parts of France it is mown three times. The rye in France is very liable to a disease called *ergot*, which seems to be unknown here; and which produces, in those who eat the grain so affected, the most dreadful complaints. The average produce of rye, when reaped, is very small, perhaps not more than 15 or 16 bushels the English acre.

Rye.

Produce.

The annual produce of wheat, rye, barley, and oats, which may be considered as the chief arable products of France, has been differently estimated; and, indeed, only an approximation to the truth can be looked for on this account. According to Vauban, in his time, the annual produce of these grains was 59,175,000 septiers of 12 Paris bushels, or 240 pounds weight. According to Quesnay, the father of the sect of the economists, it was 45,000,000 septiers. In the opinion of the Abbé d'Expilly, 78,472,380. Lavoisier calculated it at 50,000,000 septiers; and Mr Arthur Young at 75,000,000. The variations here are very considerable; but if we take the average of all these sums, it will give 61,519,672 septiers, as the annual produce of wheat, barley, oats, and rye, in France. The proportions of these different grains, it is not easy even to conjecture with any probability of approaching the truth. Rye and wheat are certainly produced in by far the greatest proportions; perhaps, in pretty nearly equal proportions. Barley and oats are cultivated on a very small scale; the latter, especially in the south, from the two great heat of the climate, are not so much grown as in the north, and where grown, are in general unproductive.

Beans.

Beans, such as we cultivate in England, are principally grown in French Flanders; besides these, the French grow what they call *feves de marais*, or beans of the marsh, which they eat only when green and fresh. They also dry them, but in that state, they serve only as food for cattle. Some persons eat them in Lent, buying them green, and peeling the skin off, they split them in two, and dry them in the open air. Haricots or kidney beans are pretty generally cultivated as a fallow crop; they are carefully hoed, and are very productive.

Maize.

The limits of the maize district have already been noticed, in treating of the climate of France; and the importance of this grain in an agricultural point of view, has also been sufficiently pointed out; in the account of the rotations pursued in the south of the kingdom. It is planted in rows or squares, so far asunder that all necessary tillage may be given between them. A considerable part of the summer it affords, as it were, a rich meadow, the leaves being stripped regularly for oxen, affording a succulent and most fattening food, which accounts for the high order of all the cattle in the south of France. The meal of maize, besides being used extensively as food for man, is also employed for fattening oxen, hogs, and poultry. Thus it appears that this most valuable grain is a meadow to feed the cattle in summer, and nourishing food to fatten them in winter. In some parts of France, it is sown broadcast and thick, for the purpose of mowing to suit cattle. This practice is pursued in the northern districts, where the climate is not sufficiently warm to ripen it; and even in the southern districts it is not uncommon to sow it as an after crop, in the same manner, and for the same purpose. Near Rousillon, it is sown in May, to be cut green in August, at which time more is generally in progress, to be applied to the same purpose in December. In the north, it is sown in the beginning of May, on well dunged fallow, and cut when beginning to come into ear. An arpent will maintain four cows from June to September; and the wheat that succeeds is always good. Although maize is undoubtedly an exhausting crop, yet in the Pays de Basques, on the low and humid lands of that province, it is cultivated for three years successively without manure; and this mode of farming, which is particulary mentioned by M. Parmentier in his *Memoire sur le Mais*, is even recommended as good by that auther.

As maize, where intended to stand for harvest, is always planted in rows, little seed is required; in general, only the eighth part of the seed which would be necessary if wheat were sown; and the arpent yields more than double of that grain. In some very fertile and well managed spots, an arpent has yielded 2400 pounds. It is commonly ripe in the month of September; and even when later, the grain is protected from the inclemency of the season, by its broad and strong leaves. It is usual, in most parts of France, to spread it under the roofs of the cottages to dry; the eaves of the houses being made to project 10 or 12 feet from the plane of the walls for this purpose. When the corn is cut, it is tied up in bunches, and suspended from light rafters, horizontally placed under the shelter of these eaves.

k wheat.

Buck wheat is cultivated to considerable extent, particularly on the poorer soils; and being of rapid growth, sufficient time is allowed to clean the land, before the succeeding crop of wheat or rye is sown. It is much used as food for man; and, in some parts, as has been already noticed, as green food for cattle: in this case, it is a stubble crop.

ips.

A very few years before the Revolution, considerable exertions were made by the intendants of the several provinces, to introduce the regular and general culture of turnips. They distributed seed, and published small treatises on the proper management, and great advantages of this root; but their exertions seem to have been in a great measure unsuccessful; for turnips are very little cultivated in any part of France. Mr Birkbeck, who travelled in 1814 from Dieppe through Paris and Lyons to the Pyrenees, and back by the route of Toulouse, says, he did not see a single acre of turnips, or even of *raves*, in his whole journey. That they are not grown in the south of France, he ascribes to the extreme dryness of the climate. This undoubtedly would render them a very precarious crop; but when he assigns the severity of the winter in the northern districts of France, as the cause of their not being cultivated there, his reason does not seem equally good. In fact, they are cultivated in French Flanders, in Alsace, Lorraine, and in other districts in the north and east; and it appears from Mr Young's Tour, in 1787, 1788, 1789, that at that period they were not entirely unknown even in the middle and southern districts. In the department of the Lot, *raves*, that is a kind of turnips with a carrot root, long, thin, and poor, are cultivated; these are also grown near Caen in Normandy, in the road to Bayeaux; and in Bresse, or the department of the Ain, where they are known under the denomination of *navets*. Between St Palais and Bayonne, many turnips are grown in a singular husbandry; the wheat stubble is either burnt by itself, or where it has not been left long enough, straw is spread over it, and then it is set on fire. The ground thus cleaned of weeds, as well as manured, is then sown with turnips. On the whole, however, the culture of this valuable root is very partially known in France; and where known, is miserably conducted, as no hoeing is ever given to it.

Potatoes.

Potatoes have not been long cultivated, even as a garden crop, in France, and as a field crop to any extent, or under good management, they are yet comparatively little known. The Lyonnois was one of the first districts in France where they were cultivated. At their introduction, they were called white truffles, from the root resembling the truffle in form, and from their being dry, like a truffle, out of the ground. It is computed, that since this valuable root was brought into general use in the Lyonnois, the consumption of corn has been lessened one-third; the inhabitants give them to their cattle and poultry, and the poultry of this district is highly celebrated. Soon after M. Turgot was appointed intendant of Limoges, A. D. 1761, he introduced into his generality the cultivation of potatoes. The people at first regarded this root with apprehension, or disdain, as beneath the dignity of the human species; and they were not reconciled to it, till the intendant had caused it to be served at his own table, and to the first class of citizens, and had introduced it among the fashionable and rich. At present, a vast quantity of potatoes, of a tolerable good quality, are grown in the provinces of Poitou, Normandy, Limosin, Gatinois, and the Isle of France, as well in less quantities in other districts.

Cabbages.

Cabbages are cultivated in French Flanders, Alsace, and a few other districts. In the neighbourhood of Strasburg particularly, this plant is cultivated on a very extensive scale, but almost entirely for the consumption of Holland and Mentz, to which places it is calculated that cabbages to the value of above 30,000 crowns are sent annually. In French Flanders, the *Brassica arvensis* of Linnæus, there called Colza, is cultivated in astonishing quantities by the farmers. There are two kinds of colza, one called white colza, because the leaves of the flower are white; the other, cold colza, the leaves of which are larger and thicker. It has this name, because it supports better the rigours of winter. This plant is cultivated on rather a strong rich soil. There are two modes of sowing it; either in a nursery to be transplanted, or in the usual mode. The white colza requires less manure than the cold colza. The seed is commonly ripe about the end of June or July. The plant is cut with a sickle, having a sharp edge. Colza intended solely for winter food, is sown in June in a field prepared for the purpose; it is cut, and given to the cattle in the course of the winter; and afterwards the stalks are cut some inches above the surface of the earth, and they will furnish a second crop of leaves in the spring. Colza furnishes the best oil that can be extracted from the seed of the north. In the central parts of France, the oil of walnuts supplies the want of the colza, which is but little cultivated there. The mass remaining after the extraction of the oil, makes a good winter food for cattle. The corn that is sown after this plant is generally both abundant, and of excellent quality.

Rape. Rape is extensively cultivated in French Flanders, Artois, &c. but not in the other districts of the kingdom. The plants are raised on a small quantity of ground, that has been fallowed, well dunged, and worked repeatedly by the binot or plough. The rape is afterwards transplanted into a field, that had formerly produced winter barley, or winter wheat. The young plants are put into the ground, either by the dibble, or by the plough. Rape is grown either as green food for sheep, or for the sake of the oil. The latter is the more common, as well as the more profitable. In a small circle round Lisle, there are 460 windmills for extracting oil from the seeds produced in that neighbourhood. In the year 1810, the produce was estimated as follows: 1st, 180,000 pictolitres of oil, at 100 francs each, in English money £817,580; 2d, The cakes valued at one-sixth part, £136,260; the total value of the produce £953,840. The crops of wheat after rape in French Flanders, are reckoned to be better than those that are grown after fallow. Poppies are also cultivated in the northern districts of France for their oil.

Spurry. In the same district of France, where indeed the most spirited and successful agriculture is carried on, spurry (*Spergula arvensis*) is cultivated. After the crops have been reaped, the grain is slightly ploughed and sown with it. In October, the cows are tethered on it. The butter from the milk thus obtained, is called spergula butter, and it is employed for the use of the kitchen, as being both cheaper and more profitable than any other for that purpose.

Parsnips. In some parts of Brittany, parsnips are cultivated. The seed is sown in February or March, and the parsnips are raised out of the ground in October or November. They are chiefly employed in fattening cattle and hogs.

Lupins. Lupins (principally *Lupinus albus*) are grown very extensively in the southern districts, either on the wheat stubbles, as winter food for their flocks; or for the sake of the seed, which is eaten by the inhabitants.

Clover. Of all the species of clover, trefoil, or yellow clover, is most abundant, especially in the south. It is generally sown as forage on the wheat stubbles. In the district of the Pyrenees, these are ploughed in the beginning of August, and the clover seed is harrowed, or rather rubbed in by means of a piece of wood fixed to the plough. This clover produces much luxuriant and valuable food for sheep and lambs early in the spring, after which it is watered, and produces by the end of May a full crop of hay; it is then ploughed up, and haricots, maize, or millet planted, either of which is off in time for putting in wheat. The other kinds of clover, till very lately, were scarcely met with any where except in French Flanders; but within these very few years, what the French call *Prairies artificielles*, which were less properly artificial grasses, have been introduced into several districts. Still these and turnips, the two grand distinguishing features of good husbandry in Great Britain, are comparatively little known or valued in France.

Lucerne. The case, however, is very different with respect to lucerne and sainfoin. The culture of the former is one of the principal features of French husbandry. It is the medica of the ancients, so called because it came originally from Media; and spreading through Persia, it became at length known to the Greeks, who cultivated it assiduously, and recommended it highly. From Greece it was transferred to Italy, and before the time of Cato or Virgil, it was in the highest credit with the Romans. It flourished with them as long as their empire flourished. Before the destruction of the empire, it seems to have been carried into Spain; or perhaps it was introduced there by the Moors, with whom, during their abode in that country, it was in high esteem. When the arts revived, it returned again into Italy, and was assiduously cultivated in that country, especially in the kingdom of Naples; thence it advanced into the southern part of France; and from the place where it was first or principally cultivated, it was called *grand trefle*, *trefle*, or *foin de Bourgogne*. The era of its introduction into France is not accurately known; but as it passed from that country into the Palatinate, upwards of 250 years ago, it of course must have been longer cultivated in France. It is now grown in Picardy, Isle of France, Rousillon, Languedoc, Gascony, Poitou, Touraine, Artois, Normandy, Dauphiny, and Provence, to a great extent, and partially in other districts of the kingdom. It is invariably sown broadcast, and generally without corn, though sometimes with oats. It is cut for the first time, in the southern districts, about the end of April; in the northern districts of course later. Where irrigation is practised, it is watered every 40 days after the first cutting, to the extent of five cuttings in all. If the land be not watered, it is cut thrice with a full product, where the soil and climate are favourable, and the management good. The watering, however, brings it to maturity, or rather decay comparatively quickly, since in this case its duration is not above seven or eight years, but on other lands twelve, sixteen, twenty, and even thirty years. In some parts of Rousillon, they take three crops of wheat after lucerne. This crop is apt to get weedy. In which case, in some of the southern districts, it is cleaned by means of ploughing it in the winter with a narrow pointed share, during frosty weather. This operation, performed at this season, kills the weeds, but does not injure the lucerne. Where the land is not very rich, or where it is not intended to crop it severely, the practice of sowing wheat after it, is not pursued; but barley and oats cut green, or made into hay, and not suffered to ripen, are taken. By this management, the roots of the lucerne, which are not easily or soon eradicated, and which would prove injurious to crops of corn, are turned to advantage, the shoots from them mixing with the forage of the barley or oats. The produce of course varies considerably in weight. In the neighbourhood of Liancourt, where it is well managed, three cuttings will yield 1600 bottles of hay, each of 12 lb. or 19,200 lb. which is above seven tons the English acre. In general, the crop may be estimated at 12,000 lbs. or rather more than five tons the English acre. The hay made from the two first cuttings, is generally given to horses. The hay from the three cuttings to cows. We have been thus particular in our account of the lucerne husbandry of France, since, as we have already remarked, it forms one of its best and most distinguishing features.

Sai Sainfoin is not nearly so generally cultivated, and certainly by no means so well managed, nor so valuable a crop, either in its actual produce, or as a preparation for other crops, as lucerne is. In England, sainfoin generally lasts from eight to twelve years. In France, it seldom lasts more than four or five years. It is usually sown with a second or third crop of corn; and, in some places, the farmers do not think of this grass till their lands are so full of weeds, and so exhausted, that they will produce corn no longer. This management, and the circumstance that their leases are generally short, seldom extending beyond nine years, sufficiently accounts for this crop not being kept in the ground so long as it is in England; for certainly with respect to soil, France is peculiarly favourable for this crop; and yet in some of the districts where it might be introduced with great advantage and profit, it is not grown. **Tobacco.** The culture of tobacco was formerly prohibited in France, except in certain parts: as Pont de l'Arche; Normandy; Vertus, in the department of the Marne; Picardy; Mont Auban; Tonnung, a small town in the department of the Lot and Garonne; Clerac, another town in the same department. Hainault, Artois, and Franche Compté, were similarly privileged; but the soil of these provinces was decidedly hostile to the cultivation of the tobacco plant. At present, it is principally cultivated in Alsace. The average produce of France is estimated at twelve million pounds annually; but the quality is not good.

Millet. It has already incidentally appeared, that millet is cultivated to a considerable extent in the southern districts of France. In some parts of Gascony, it is sown on three feet ridges, with three irregular rows on each ridge, and carefully hoed. In other parts, it is sown ridge for ridge in the same fields with rye. In order to free the millet from its chaff, the French pound it in a wooden mortar, or pass it between millstones, which they keep sufficiently asunder, to prevent the grain being crushed. In the southern parts of France, especially in the vicinity of Bourdeaux, they prepare from the winnowed millet seed boiled in milk, a very favourite mess, not unlike rice milk; they also make the seed into cakes, pastry, &c. Millet is a grain, that thrives well under irrigation, which is liberally bestowed upon it in the districts of the Pyrenees.

raway. Caraway grows plentifully in France, and is sent particularly from Languedoc and Provence in large quantities to Paris, where there is a vast consumption for it among the druggists, apothecaries, confectioners, distillers, &c. **x.** Flax is cultivated largely in many parts of France; but more particularly in French Flanders, Alsace, in La Maine, Anjou, Languedoc, Brittany, and Normandy. It is also found in the garden, or small farm of every peasant, for domestic use. The flax husbandry is carried to the greatest perfection in the vicinity of Lisle, where it is raised every six years without injuring the soil. Land that has carried a crop of wheat or oats after clover, is preferred. Repeated ploughings, harrowings, and plenty of rape cake or night soil, are given. In every part of France where flax is cultivated a *good* crop, that is, flax of fine quality, is preferred to a large and coarse crop; hence perhaps they obtain the fine stapled flax, of which their cambrics and lawns are made. **p.** Hemp is cultivated in Flanders, Picardy, in the territories of Rennes, St Malo and Dol in Brittany, where the hemp fields occupy a very large space; in Upper Languedoc, and in Auvergne, where the soil is peculiarly adapted to its culture. But perhaps of all the provinces of France, Alsace, especially part of what is called the plain of Alsace, is most deservedly famous for the culture of hemp. It is also sown like flax in the gardens, &c. of the peasants, for their domestic use. Neither hemp nor flax is cultivated in sufficient abundance for home consumption. Previously to the Revolution, the naval consumption alone of hemp was 400 millions of pounds, more than one-third of which was imported.

Madder. Many plants used in dyeing are cultivated extensively in France. Madder is grown in the vicinity of Avignon, and in other parts of the south, but to a much greater extent in Alsace. Into this province it was introduced during the reign of the Emperor Charles V. and by the exertions of that sovereign himself; but the cultivation of it was not of much consequence till about sixty years ago, since which time the growers and makers of it have been able to rival the Dutch in supplying the manufactures of France. This extended cultivation was principally the effect of a decree of council in 1756, which promised privileges and exemptions to those who, in clearing marshes, should plant them with madder; for though it was soon found, that this plant will not thrive nearly so well on marshy land as on a dry and kindly soil, yet this measure of the French government directed the attention of the farmers of Alsace and other districts to this plant. Before the Revolution, it was calculated that 3000 acres were under madder in the department of the Lower Rhine, and principally in the vicinity of Haguenau. The Revolution was injurious to its cultivation; for, in 1796, 7, 8, and 9, there were only 600 or 700 acres in cultivation: in 1800, the plantations had increased to 850 acres; and, since that time, the culture has extended, though it has not nearly reached what it was before the Revolution. An acre produces, in common years, 12 or 15 cwt. of dry madder. The crop of 1778 was uncommonly abundant, being 50,000 cwt.; in 1780, 34,000 cwt. was produced; in 1798, only 8000 cwt.; in 1799, 10,000 cwt.; at present, about 15,000 cwt.

After much trouble and repeated trials, the manufacturers of madder in Alsace succeeded in rendering it nearly equal in quality to that of Zealand; and it is said, that Germany and Switzerland prefer it for their red dyes. On account of the smallness of the crops, the whole produce is consumed within the year by the circumjacent manufacturers, except a small quantity that is exported to Switzerland and Germany; but from 1776 to 1796, when Lower Alsace produced annually from 40,000 to 50,000 cwt., about one half was used in France alone; the remainder went to England, Germany, Switzerland, and even Italy; houses at Genoa, Milan, and Leghorn, being supplied from Haguenau. There are nine fabrics or manufactures of madder in the department of the Lower Rhine, besides which there are five madder mills, and about eighty dyeing houses.

Weld. Weld is very common in many of the French provinces, particularly in the environs of Paris; and in Normandy, especially about Rouen. It is usually sown in the fields after harricots, hoed frequently, and dried carefully after cutting.

Woad. Languedoc has long been famous for its cultivation of woad: the best grows in Upper Languedoc, particularly in the diocese of Alby. What we style a ball, they call *cocagne;* and such a source of wealth was this plant in former times, that *pais de cocagne* is still a French phrase for a country of abundance. This arose, not merely from the great quantity of woad sold, but from its leaving the soil in an excellent state for grain, in consequence of the extraordinary culture which it required. At that period, it was the great staple of

Languedoc; but, by the decrease of the demand for it at home and abroad, the culture of it has comparatively declined, and given place to that of millet. In Languedoc five crops are gathered in one year. Great care is taken both in the cultivation, and in the subsequent preparation of it. When the leaves become yellow, they are gathered and carried directly to a mill, much resembling the oil or tan-mills, and ground into a smooth paste. This is laid in heaps, pressed close and smooth, and the blackish crusts, which forms on the outside, reunited, if it should happen to crack. In this state it lies for fifteen days, when the heaps are opened, the crust rubbed and mixed with the inside, and the matter formed into oval balls, which are pressed close and solid in wooden moulds. These are dried upon hurdles: they turn black on the outside if exposed to the sun; if in a close place, yellowish, especially if the weather be rainy. The dealers prefer the first. The good balls are distinguished by their being weighty, of an agreeable smell, and of a violet colour within when they are rubbed.

Orchilla. Orchilla weed can scarcely be said to be cultivated: it however grows in abundance, and of a good quality, in Auvergne. There is also in this province a kind of moss different from the real orchilla, known by the name of *orseille de terre, orseille d'Auvergne*, which is used for dyeing, but it contains fewer and lighter colouring particles. The real orchilla is prepared in France, for the purpose of dyeing, by being ground betwixt stones, moistened occasionally with spirits of wine, and so made up in a paste, which they call *orseille en pâte*. **French berries.** French berries, that is, the berries of the *Rhamnus infectorius*, are grown abundantly in the south of France, particularly in the vicinity of Avignon, whence they are called *graines d'Avignon*. They are used considerably in the south and middle of France, to give a yellow dye, chiefly for silk. They are gathered unripe, bruised, steeped, and then boiled in water mixed with the ashes of vine stalks, to give a body, and then passed through fine linen. The colour they give is fine, but very evanescent, especially when exposed to the sun.

Saffron. Saffron is cultivated about Toulouse, Angouleme, in the principality of Orange, near Avignon, in Normandy, Angoumois, and Gatinois. The best saffron in France comes from Boisne in Gatinois, where the soil is a mere sand. The saffron of Angoumois is perhaps next in quality, and is grown there in great abundance. This plant seems to have been introduced into Spain by the Moors, and from Spain into France. The roots are liable to many maladies in France, which are unknown here. There is nothing peculiar in the mode of culture, except that sometimes, in the very height of the season, they pull the flowers in the evening as well as in the morning, instead of only in the morning, as is practised in England. **Turnsol.** Turnsol, a valuable dyeing drug, is prepared chiefly in the village of Grand Gargues, near Montpellier, from the *croton tinctorum*, which the French call *marille*. The flowering tops, in the latter end of July or beginning of August, are prepared by a long process, and linen or woollen rags dipped in their juice. These are packed and sold under the name of *tournois en drapeaux*. These shreds are chiefly used for tinging wines, cheese, linen, and paper.

Sumach. Sumach is cultivated in the neighbourhood of Montpellier, where it is called *rèdout*, or *roudou*. Its shoots are cut down every year quite to the root, and, after they are dried, they are reduced to powder in a mill. Horehound is another plant used in France for dyeing. To it the French manufacturers are chiefly indebted for the deep black colour of their cloths.

But our limits will not allow us to enumerate all the plants raised or used in France for the purposes of dyeing; and we must also omit the medicinal plants, of which there are not a few in the southern districts; as well as the aromatic plants, which grow in great abundance all round Montpellier, and furnish those perfumes for which this place is famous. **Capillaire.** We may, however, just mention, that in the vicinity of Montpellier the *capillaire* (maiden's hair) is particularly abundant, and the syrup made from it is in high reputation all over Europe.

Hops. Hops are also grown in France, but their cultivation is not distinguished by any peculiarity or excellence, nor are they grown in nearly such abundance, nor of so good quality, as in England; the demand for them being much more limited, in consequence of the comparatively confined use of beer as a beverage.

Teasels. Teasels are cultivated with much assiduity in Languedoc, Normandy, and Picardy, for the same purpose for which they are grown in England. Those of Picardy are esteemed the best that grow in France. According to the trades in which they are principally used, they distinguish them into *chardon bonnetier, chardon drapier, chardon foulon*, in general *chardon faniere*, and the smaller ones are called *tetes des linots*, linnets' heads. They commonly transplant their teasels in France, in order to improve their heads, and in some places horse-hoe them. Before the Revolution, teasels were regarded as so essentially necessary in the manufacture of woollen goods, that the exportation of them was prohibited, except by licence. But now in France, as in England, their use is in a great measure superseded by improvements in machinery.

Sparto grass. Sparta, or sparto grass, a species of fibrous grass, or junk, grows abundantly on the sea-shore in Provence, Languedoc, and some other provinces of France. It is employed not only in the manufacture of ropes, but in that of mats, and a sort of carpet, which is looked upon in France as being extremely ornamental to a room. Swallow-wort, a hardy plant that grows in the south of France, contains in its seed-capsules a kind of silk, that is used for stuffing pillows, and also for manufacturing paper of a superior quality.

Harvest. The harvest in the south of France generally commences about the middle or end of June, in the central provinces about the middle of July, and in the north of France about the beginning of August; but in the high grounds, especially in Auvergne, the harvest is very late, oats being not unfrequently green in the middle of August. It has already been mentioned, that women are principally employed in the harvest operations: indeed, agricultural operations of all kinds are conducted more frequently, and on a more extensive and independent scale, by them in France than in most other countries. The Hainault sickle is used in French Flanders, and in parts of the north and east of France: The sickle more generally, and the common scythe in some districts, even for the wheat. The harvest operations are by no means carried on with neatness or method; and the excellence of the climate is such, in most parts of the kingdom, that these deficiencies are seldom attended with much loss.

Thra Scarcely any corn stacks are to be seen in France; by far the greatest part of the corn being either put into barns, the size of which, in some districts, is enormous, or thrashed out immediately after harvest, in the open fields; this mode of thrashing, however, can be practised only in the southern parts of the kingdom. There harvest is not considered as finished till the thrashing is done. Where it is performed by the flail in the open field, the thrashing-floors are generally in a corner of it, if thrashing-floors they may be called; for all the preparation is merely shovelling aside the loose mould and a good sweeping. The size of course is in proportion to the number of people, which is from two to twelve; rarely more than the latter. They thrash and winnow about seven Winchester bushels in a day. Where the corn is trodden out, instead of being thrashed by the flail, horses and mules are employed: oxen, which are used in most of the other operations of husbandry, are seldom or never employed in this. The number of horses or mules varies: sometimes there are four mules and four men; sometimes only two mules and two men; sometimes twelve or fourteen mules or horses together, and sometimes even as many as twenty-four. The mules or horses, as well as men, are generally hired at forty sous for each mule or horse, and the same for each man: the latter have their board besides. With 24 horses or mules, their drivers (who are paid in kind, three sacks per hundred of the grain thrashed,) and 15 men, it is calculated that they can thrash of wheat from 120 to 180 bags of 200 lbs. per day; at an average of 150 bags per day, it costs about 4d. per English bushel. The common practice is to lay three or four layers of wheat, barley, oats, &c. upon some part of the field, generally under a central tree: the horses and mules are then driven upon and round it, in all directions, a woman being in the centre, like a pivot, and holding the reins: the horses are sometimes driven by little girls. The corn thrashed out is cleared away by the men; others winnow it; others heap it; others supply fresh layers. After the corn is separated, they continue treading the straw, until it is reduced almost to chaff, to improve the fodder, and forward the maturation of the dung. Such is the stability of the climate, that this process is going on in the open air, through the whole country, without any means of protection against a sudden change. Indeed a soaking rain could not possibly do harm, as a day's sunshine, or even the heat of the night, would soon evaporate it.

nures.

The means used in France to improve the soil or particular crops are, manures, draining, paring and burning, and irrigation. In most of the districts, there is nothing very peculiar in the manures employed, or in the mode of managing them. The small towns and villages in the autumn, present a disagreeable scene; from one end to the other they are littered with straw, like a farm yard, for the purpose of its being converted into a manure, so that it is like walking all the way upon a dung-hill. When the straw becomes sufficiently saturated, it is piled on each side the door of the proprietor's house, to make room for fresh straw being laid on; so that besides the dung-hill in the street or path, there is a range of them on each side. In French Flanders, very minute and particular attention is paid to the subject of manure. In the vicinity of Lisle, the dung of cattle and horses with the straw; ashes; lime; the urine of animals collected with care in brick cisterns; the cakes of rape and hemp-seed reduced to powder in a mill, and sometimes put in the urine cisterns; sour water obtained by washing the tubs of starch-makers; the urine of cattle fattened at the distilleries, which sells at a high price; the dung of pigeons; that of sheep carefully gathered; marl; the refuse of horns, and night soil, are carefully and judiciously employed. Although the price of this last article is only 3d. per ton to the scavengers, and 9d. to the farmers, the town of Lisle alone produces as much as would sell for about L.4200 a year. Besides these manures, Dutch ashes are extensively employed as a dressing for clover: these are the ashes of the peat or turf brought principally from Friesland: by their application, great crops of clover are raised, and the subsequent crops are also improved. From the nature of the soil and climate, draining is requisite only in very few parts of France; and in the practice, there is nothing particular or commendable. The marshes in some of the sea districts have been partially drained, but this improvement is by no means carried on with spirit. Louis XIV. made a present to Marshal Turenne of the marshes of Bourgoigne, in the department of Isere, on condition that he would drain them; but neither he nor his successors have ever accomplished it. In some provinces, a singular kind of husbandry is practised; the ponds are drained, and cultivated for a few years, till they lose their fertility, when the water is again permitted to accumulate, and the same process is repeated. Respecting paring and burning, which is very partially practised, and scarcely ever for any other purpose, or at least with any other effect but to impoverish and exhaust the land, it is unnecessary to enter into details.

Irrigation.

Irrigation is the most remarkable feature in the mode of improving land in France, or, to speak more correctly, in the mode of increasing its fertility;—and its effects are wonderful. Irrigation, however, is by no means general: in travelling from Calais to the Pyrennees, Mr Young observes, he first met with it in La Marche, between La Ville au Brun, and Bossie, after he had passed over considerably more than half the kingdom; thence it is practised, with little interruption, to the Pyrenees, and the whole district of those mountains from Perpignan almost to Bayonne is watered. Through all the north of France, comprehending every thing north of the Loire, there are only a few imperfect traces of it in some parts of Normandy, and in the Beauvoisis. In Picardy, Flanders, Artois, Champagne, Franche Compté, Burgundy, and the Bourbonnois, it is unknown. In Alsace and Lorraine, it is partially practised for their meadows. On the whole, hardly more than one third of the kingdom can be said to understand and practise irrigation.

In the Cevennes.

But where it is practised, it is upon a large scale, and with wonderful spirit and success. By means of it, artificial fertility is conferred on some of the barren mountains of the Cevennes. As the waters that run down the sides carry considerable quantities of earth into the ravines, walls of loose stones are constructed, which permit the waters to pass when they are clear; but when turbid, their load of earth is gradually deposited against the wall, and afford a quantity of excellent soil. Successive ramparts are thus erected to the very top of the mountain; and the water having no longer a violent fall, nourishes, instead of injuring the crops. In order to give security and consistence to the new acquisition of soil, fruit trees are planted at certain intervals. Perhaps the greatest exertion in irrigation to be seen in France, occurs in Languedoc, in the vicinity of the town of Gange: a solid stank of timber and masonry is formed across a considerable river between two rocky mountains, to force the water into a very fine canal, in which it is, on an average, six feet broad by five deep, and half a mile long, built on the side of a mountain, and walled in; a wheel,

In Languedoc.

with a hollow periphery, raises a portion of the water of this canal to the height of 30 feet; an aqueduct conducts it on arches built on the bridge, across the river, to water the higher grounds; while the canal below carries the larger part of the water to the lower fields. Meadows are watered in some parts of Gascony, and in the vicinity of Avignon;—an unusual thing in the South of France.

In La Crau.

But the most extraordinary instances of irrigation, are to be met with in the singular desert of La Crau, already described, and in the Pyrenees. In advancing from Salon into the Crau, about four miles before it commences, the road crosses the canal of Borsgelin. "The old canal of Crappone, at the same place, is seen distributing water in various directions, for the amelioration of one of the most arid tracts that is to be met with in the world. The canal of Crappone takes its waters from the Durance at La Roche, and carries it to the southern part of it at Istres. This canal is 40 miles long. That of Bois Selin receives it from the same river at Malavort, and crossing the other, divides it into three branches: one of which leads to the lands in the neighbourhood of Istres; the second to St Saumus and Magran, and this part of the Crau; the third is a small one that turns to the left towards Salon. In consequence of water being thus conducted to a region where it is so much wanted, some very capital improvements have been wrought. Some large tracts of the Crau have been broken up, and planted with vines, olives, mulberries, and converted into corn and meadow." The corn has not succeeded; but the meadows, according to Mr Young, are amongst the most extraordinary spectacles that the world can afford, in respect to the amazing contrast between the soil in its natural and in its watered state, covered richly and luxuriantly with clover, chicory, ribgrass, and *avena elatior*.

In describing the irrigation of the eastern Pyrenees, we shall use the words of Mr Birkbeck, who, in his tour through France in 1814, observed every thing relative to its agriculture with the eye of a most shrewd and intelligent observer, and who has recorded his observations in the most clear and impressive manner.

In the Pyrenees.

"The copious and pure streams issuing from the Pyrenees, from their source to their union with the Mediterranean, are most economically and skilfully directed to the purpose of irrigation. On the mountain sides, the streamlets, as they trickle from the rocks, are collected into channels, above every little portion of arable ground, which they render surprisingly fertile. These rills uniting, form larger streams; and these, with great labour and ingenuity, are kept up by artificial channels, and only suffered to descend as they perform the office of irrigation. The same attention is paid to the larger streams united, which become a considerable river in the lower lands of Rousillon. This is divided and subdivided, unites, and is again divided, so that every portion of the surface seems to enjoy its due share. The soil of Rousillon is sandy, and apparently not very rich; but, by the joint influence of water and sun, vegetation is vigorous beyond any thing I had ever before witnessed. Where a mountain side, or a portion of the land, is so situated, as to be inaccessible to the water, it is planted with vines, to which watering is not applicable, as it injures the quality of the wine, without increasing the quantity sufficiently to compensate. On the contrary, to olives, irrigation may be applied with prodigious advantage, an instance of which came under my observation. This crop had generally failed, owing to the extraordinary coldness of the early part of the summer; and one half of a large olive ground was, like the rest of the country, without fruit; the other half, which had been watered several times, was laden to a degree equal to the most plentiful season. How this country, and other vallies of the Pyrenees, were originally laid out so judiciously with channels of irrigation, systematically arranged for the benefit of the whole, is a mystery I have not heard explained. A master's hand seems to have planned and executed all, before the appropriation of the soil, otherwise private interest would have interfered and marred the design. However that may have been, every man now finds a '*canal d'arrosement*' passing above his field, and a '*canal de dessechement*,' at the bottom, which latter is the '*canal d'arrosement*,' in its turn for the land below.

The manner of applying the water is extremely simple. A dam is made across the upper channel, from which the water flows gently into a furrow made by the plough along the higher side of the field, and in a few hours soaks through the whole soil, until it reaches the lower side, which completes the operation.

The following, which is one of the usual practices of the district, may shew what this amphibious husbandry can effect. In August, they *scratch* the wheat stubbles with their little Roman plough, which does not turn a furrow, or move a fourth of the surface. They then sow annual trefoil, which they cover very slightly by planking, that is, drawing a plank on which a boy rides, over the land, thus breaking the clods and smoothing the surface. This is equivalent to our rolling, as the scratching is to our ploughing. The weeds and stubble are but little affected by this process of ploughing and planking. However, that matters not, for the water is now introduced; the trefoil starts as it were instantaneously; and in October or November is three deep, and fed off by the sheep. Water is applied from time to time; and in January or February it is fed again; and lastly, in May it is mown for hay, a heavy crop. Immediately as the hay is removed, another scratch is given, millet or haricots are sown, irrigation goes on, the crop is reaped; and the ground receives four ploughings, as a preparation for another crop of wheat, to be sown in October or November. This is the history of one year, under familiar and constant practice."

The richest arable land, when watered, sells for nearly double what land of as good quality not capable of being watered will bring. Besides the districts already mentioned, where irrigation is practised on a large scale, and with great skill and effect, every spot of land in the mountains of the Limosin is watered; and a considerable part of the vale of the Limagne of Auvergne, as well as some of the mountainous districts of that province. At Isoire near Clermont, the gardens are planted in quick succession by means of it. There are also here what they call *vergers*; that is, watered meadows planted with apples and other fruit trees, which are very productive. Irrigation is applied to the culture of hemp in Auvergne.

Besides the improvement of the mountainous districts in the centre and south of France by means of irrigation; by another process, calcareous mountains, which generally rise in shelves, are rendered productive by cutting away the rock behind the shelf, which supplies materials for a low wall around the edge. The interval is afterwards filled with earth, and the barren mountain is crowned with luxuriant terraces.

SECT. II. *Meadows—Pasture—Horses—Mules—Oxen—Sheep—Poultry—Bees—Woods and Forests—Fruit Trees—Vine Husbandry—Wines—Brandies—Vinegar—Horticulture.*

IT must have sufficiently appeared, from the account already given of the agriculture of France, that the meadows and pastures of that country bear a very small proportion to the arable land, and that comparatively little dependance is placed on their produce, for the breeding or fattening of cattle or sheep. Indeed as the cattle and sheep of great tracts of arable land are entirely supported on clover, lucerne, &c. and as the climate of by far the greatest part of the kingdom is not well suited for meadows or pasturage, the French agriculturists have little reason to regret, or alter this feature in their husbandry. The author of the *Credit National* calculates the meadows at 15,000,000 arpents; that is, at one-fourth of what he makes the arable land. But Mr Young conceives that they do not amount to one-third of that quantity, and estimates the meadows and rich pasturage together at 4,000,000 English acres; not 1-17th of the arable land. This seems a very small proportion; but it will not be deemed too small, when it is recollected, that in those districts where in England we find extensive meadows, that is, by the sides of the rivers, there are in France very few, and those very inconsiderable. For instance, the plough moves to the water's edge of the Marne. There are very few meadows on the banks of the Loire. The Seine is bounded either by hills covered with wood, or by gravelly plains under tillage. The land near the Garonne is principally arable; and the Rhone presents rocks and vines on its banks through the greater part of its course. On the smaller description of rivers, indeed, there are meadows, especially on the banks of the Saone; but it is evident that these taken together can form a very small proportion indeed of the area of France.

Meadows.

stures.

The most extensive, and certainly the most fertile, pasturages in France are to be found in Normandy. The moisture of the climate, aided by the generally deep and rich soil of this province, is extremely favourable to pasture; and as the farmers here are certainly equal at least in intelligence, capital, attention, and skill, to those in any other part of France, those advantages are turned to the best account. The grazing lands of the Pays d'Auge are particularly celebrated; and of these, the Valley of Corbon may perhaps class with the finest to be found in any country. In 1789, when Mr Young visited these pasturages, the rent of the highest was about £4 : 7 : 6 the acre, measured by the perch of 22 feet; and the price about £87, 10s. the acre. In several of the provinces, there are also salt marshes that are applied as meadows, to the fattening of cattle, particularly in Normandy, about Isigny and Carentan, in Poitou, Saintonge, Languedoc, &c.

age-
t of

The management of hay in general is very slovenly. It is not unusual to see the produce of a field carried away in sheets and blankets, or even in the arms, and one-fifth of the crop lying scattered in the roads and the fields. It is in general too much exposed to the sun. The women here, as in all the other parts of agricultural labour, perform the principal part of the work, even pitching the hay into the cart. The fork they make use of for this purpose is a very awkward one. In the central and southern provinces, where the climate is very steady, the farmer stacks his hay in small cocks, where it grows, and only carries it away at his leisure. When carried to the hay loft, being merely thrown together without being trodden, it loses the little fragrance, which a burning sun acting on it, while it was making, had left it. The clover hay, however, especially in the northern provinces, is better managed; after standing for some days in large cocks, it is tied with straw bands, in bundles of 14 lb. each. The lucerne also, in these districts, is got with great care, so much, indeed, that the colour is beautiful; the green is often not in the least faded, but so vivid that it almost appears improved in drying.

Horses.

Normandy, the Limosin, Auvergne, Brittany, Franche Compté, Poitou, and Burgundy, are most celebrated for their breed of horses. Normandy has long been noted for its horses. It is said that William I. won the decisive battle of Hastings, by the superiority of his cavalry which he brought over with him. The Norman horses are in general low and thick, and very steady, sure, and strong. They will make a stage of 30 miles without a bait, and eat the coarsest food. They, as well as the horses in other parts of France, and also the cattle, are accustomed to feed about the lanes, and in the common fields, after the corn is carried off. The best saddle horses are those of Limosin. They are seldom fit for riding till they are six or seven years old; but then they are very useful, and last a long time. This breed has been lately much improved, by crossing it with the Arabian, Turkish, and English. Auvergne produces some good hacks for common use. A great many foals are reared in Brittany, which are sent to the pastures of Normandy. A great many horses are also bred in Franche Compté, especially in the hilly part of the country. One year with another, their studs produce upwards of 5000 colts, most of which are bought, when six months or a year old, by the horse dealers in Champagne, Burgundy, Brie, and Berry. The trade in horses is consequently an object of some importance and value in Franche Compté. In different parts of the kingdom, there have long been *Haras*, or *depots de chevaux* for the supply of the royal studs; and Bonaparte, sensible that cavalry is one of the main sinews of war, paid particular attention to the breed and supply of horses; but, as in many other things that he undertook, his plans were not calculated to produce the object he had in view, in consequence of the impatience, obstinacy, and tyranny of his disposition. On the whole, therefore, the breed of horses, and probably the number, are not equal to what they were previously to the Revolution. In the year 1802, the total number was, of plough horses 1,500,000; horses kept at Paris 35,100; in all other towns 200,000; in the armies 100,000: making in all 1,835,100. With respect to the number assigned for agricultural purposes, it may appear high, when we consider, that oxen are very much used not only in the plough, but in carts; and that where horses are employed in the plough, there are seldom more yoked than two. The number of horses in Paris is singularly small. Between 1802 and 1812, the number of horses, at least of those bred in the government studs, was probably much increased; but during the Russian campaign, in a few months of 1812 and 1813, the loss, according to the exposè of the year 1814, amounted to 230,000 horses, which, it is stated, could not be replaced at a less expence than 105,200,000 francs. The price of farm horses in the northern districts of France, is about £17 sterling.

Mules.

Mules are much employed in the middle and south of France, especially in the latter, for treading out the corn. Anjou carries on a particular trade for these animals, known by the name of *Mirebalais*. In the department of Aveiron, especially in the vicinity of Rhodez, the principal town, they feed a vast number of mules, in which the inhabitants carry on a considerable trade; for it is said that during the two fairs that are kept yearly at Rhodez, this trade brings in above 300,000 crowns. The breed of mules in Poitou, is particularly celebrated for their size and strength, and is in great demand all over France.

Oxen.

The provinces in which oxen and cows are principally bred or fattened, are, Perche, Champagne, Lorraine, Alsace, Hainault, Flanders, Normandy, Brittany, La Maine, Anjou, Poitou, Berry, Nivernois, Burgundy, Limosin, Auvergne, Bresse, Languedoc, and Dauphiny. The prevalent colour of the cattle in France, from Calais to the Pyrenees, is a pale reddish, or rather a cream colour. This is decidedly the colour of the cattle of the Limosin, which are an excellent breed, probably the best in France. From this district, numbers of fine oxen, fattened in winter, are sent to the Paris market, which is also supplied by those fattened in Normandy during summer. The cattle of the Limosin have short legs, strait and flat backs, well arched ribs, deep and heavy carcases, and their weight from 60 to 80 stone, 14 lb. to the stone. The most singular circumstance respecting them is, that they should be in excellent condition in the month of May, the season when they are usually driven from Limoges to the Paris market, as at this time of the year there is in most countries a scarcity of fat cattle, when they have not been fattened on spring grass; and any grass which they could have in a climate not very different from that of the south of England, could have but a small share in bringing them to the condition in which they reach Paris. The method by which they are brought into this condition is very extraordinary: they are put on grass till the beginning of November; then on *raves* or turnips. When the turnips fail, they give them rye-flour, prepared in a peculiar manner: the flour is mixed with water, so as to make a paste, which is suffered to stand till it ferments. In some instances the fermentation is promoted and accelerated by the addition of leaven. This rye-paste is never given to the oxen till it becomes sour. At first they refuse it; but when they take to it, they prefer this acid food to any other. A large ox will eat in this manner about 22 lb. of the paste a-day: it is given thrice a-day. The oil-cake of walnuts is also given to oxen in the Limosin, with the greatest success. In some parts of this district, boiled potatoes and chesnuts are given; in other parts, boiled maize rendered tender by pouring boiling water upon it.

In other parts of France, oxen are fed on leaves. This seems to have been an established custom in the time of Henry IV. as it is particularly mentioned by Oliver de Serres, who wrote, under the auspices of that monarch, the *Theatre d'Agriculture*. The practice was formerly usual in England also, in Henry Eighth's time, and even so late as the reign of Charles II. as appears from Evelyn. The leaves used in France are principally those of the beech. They are gathered when on the point of falling, or immediately after they have fallen, and are preserved as dry as possible by being covered with straw. The management of this mode of keeping cattle is best understood in Franche Compté and Auvergne.

Where the Rhone divides between Tarascon and Arles, an island or delta is formed, called Camargue. This island is nearly an equilateral triangle of about seven leagues each way. It was formerly covered with wood, but has for a great many years been cleared, and covered with rich pasture. Vast quantities of sheep and cattle are bred and fattened here. About 3000 horses are computed to be bred annually, with oxen and sheep in proportion. The oxen are reserved chiefly for the supply of the marine at Toulon. They differ in colour from those generally met with in the rest of the kingdom, being a small black breed, not unlike Scotch cattle. They make excellent beef. They are very wild, and often very mischievous; so that when the droves of them go to Toulon, they are always preceded by a man on horseback with a javelin in his hand, who keeps at a short distance a-head of them, to warn people of their approach.

Cows.

The Norman cows, similar to those of Alderney, are the most celebrated for the quality of the milk they yield. This province, especially the neighbourhood of Isigny in Lower Normandy, and Brittany, especially near Lanion, in the department of the North, and the Boulonnais, supply excellent butter, both fresh and salt. Gournay, a town in the department of the Lower, is particularly celebrated for its market of fine fresh butter, which is chiefly consumed in Paris. In the neighbourhood of Marseilles, where cows are seldom seen, milk is furnished from sheep and goats: butter is only made from sheep's milk: a kind of curd is also made from this milk, which is called *beurre frais*: it is made into little pots, and brought about by the country people for sale. Cheese is very little made in France. Languedoc, Provence, Brittany, Normandy, Forez, and Bresse, furnish it in the greatest quantity. That of Brie is esteemed the best. On the borders of the Saone are a range of hills which from their excessive fertility are called Monts d'Or. Several villages are dispersed over them, in which a very small delicate cream cheese is made. They are sent to very distant parts in little boxes, made exactly to the size of the cheese.

Butter and cheese.

It is calculated that the number of oxen employed in husbandry are about 3,208,000; feeding oxen 404,500; young oxen, 1,456,000; cows, 1,016,000; making a total of 6,084,500.

Sheep.

The native breeds of sheep in France are, 1. The Picardy, hornless, white faces, and silky, hanging ears; these are probably a bastard Flemish breed; their wool is coarse, and of middling length. 2. The Norman, with red legs and faces, and coarse wool. 3. The Berry, resembling somewhat the South Down sheep; the wool fine. 4. The Rousillon, similar to the Spanish, with very fine wool. 5. Near Mirepoix, in the department of the Upper Pyrenees, there is a sort of sheep, resembling the Norfolk breed, with horns, black faces, and legs. The leading characteristics of the native French sheep are their long legs, thin carcases, and coarse wool; the mutton in general is bad. The same characteristics prevail from north to south, except in the north the sheep are larger, stouter, and bear finer fleeces. These circumstances, however, principally arise from their being better managed in the north than in the south.

Merinos.

Louis XVI. in 1786, first established a flock of Merinos at Rambouillet. The produce, for some time, was given away. Recourse was then had to public sale. The sheep sold high, but the manufacturers did not give a proportionally high price for the wool. At this crisis, the Revolution came on. There were at that period four principal establishments for Merinos, namely, those of Rambouillet, Alfert, Perpignan, and Pompadour; but the Revolution still farther depressed the demand for their wool. In 1811, Bonaparte published a decree, by which he intended and hoped to cover France with fine-woolled flocks; but, by this ill-advised measure, the final blow was given to the Merino breed. From that time they have been declining in France. In the exposé for the year 1814, it is asserted that Bonaparte's forced attempts to introduce the Merino breed of sheep, cost the government 200 millions of francs; and that, after all, so far from succeeding, the breeds of native sheep were rather deteriorated.

Sheep are kept in all parts of France, but principally in Rousillon, Languedoc, Provence, Dauphiny, Auvergne, Guienne, Gascony, Bearn, Marche, Limosin; Poitou, Maine, Anjou, Brittany, Touraine, Champagne, Alsace, Franche Compté, Normandy, and French Flanders. In most parts of France, the sheep are shut up in stables at night, and sheltered from the sun at noon, during the summer. They are generally folded in the fields till November. When the snow is deep, they are sometimes fed on the branches of trees. On the whole, the management of sheep is bad in France, especially in keeping them too hot during night in their houses, and too confined in their folds. The flocks are not large, seldom reaching 400.

Emigration of sheep.

On the mountains of the Cevennes, which run along the northern parts of the Lower or Eastern Languedoc, numerous flocks are fed in the summer on the aromatic herbs with which they abound. During the cold of the winter, they descend into the plains. But the most extensive and singular emigration of sheep is that which takes place annually, and as regularly as in Spain, from the Camargue, or Delta of the Rhone, and the desert of La Crau, to the mountains of Provence and Dauphiny, especially to the mountains of Gap and Barcelonetta, and back again. The migration to the mountains takes place in May, whence they return again in October or November, and sometimes earlier. The migration is not regulated by any other written laws, than some arrêts of the parliament to limit their roads to five toises of breadth. If they do any damage beyond that, it is paid for. The Barcelonetta mountains are the best, as they are covered with fine turf.

The migration is conducted with all the order and regularity of the march of an army. The flocks belong to several proprietors, who reside principally about the Crau, at Arles, Salon, &c. M. Darluc, the author of the *Natural History of Provence*, as well as other writers, calculates the sheep kept in the Crau and the Camargue at one million. They travel in flocks of from 10,000 to 40,000, and are from twenty to thirty days on the journey. Among the shepherds that have the care of them, one is chosen as chief during the season. He regulates every thing relative to the march, and is treasurer for the company; all the money for the expences of the route being lodged in his hands, and he paying for every thing. In order to check him, another of the company is appointed secretary. In his presence all payments are made, and he enters them immediately in his book. The rest of the shepherds form a council, whom the chief consults in case of any difficulty. To every thousand animals, three shepherds are allowed, each of whom has his dog. In the centre of the flock, a number of asses march, carrying the provisions and baggage. The chief also takes his station in the centre: he issues the daily allowances of provisions, and transmits his orders, by his assistants, from this situation; and if any irregularity is committed, he is found there to receive the complaint. He also examines into any mischief which may be done by the flocks to the countries through which they pass, and pays the person who has received the injury: he next determines, whether it was occasioned by negligence or through accident: in the former case, the sum paid is levied on the offender; in the latter, it is taken from the common fund.

Besides the sheep, there are always a number of goats, which take the lead of the former. Some of the oldest he-goats have bells round their necks. The discipline in which these are kept, and the intelligence which they display, is remarkable. At the command of the shepherds, they either halt or proceed; and when the flocks rise in the morning, the moment these goats receive the order to proceed, they repair to their stations in the foremost ranks with great regularity. If they come to a stream, they halt, till the word of command is given, when they instantly plunge in and cross it, and are followed by the rest of the flock. When the flocks lie down at night, the shepherds and dogs still continue on the watch, relieving each other at stated intervals. When they arrive at the mountains, each shepherd has his particular district allotted him by the chief. The feed is hired at the rate of 20 sous each sheep for six months; and the price for the winter feed in the Crau and the Camargue is the same. During the whole time of their stay on the mountains, the shepherds live almost entirely on bread and goat's milk, sleeping upon the ground in the open air.

Shepherds.

The shepherds in France never inhabit a house: they go to the cottages in which their wives and families live, to take their meals, but sleep in their sheep-fold, in huts made of reeds and clay, upon a mat spread on the ground: these huts are placed on wheels. The wages of the shepherds are in general high; and they are a superior class of men, in all respects, to what they are in England. The wages of the chief shepherd are about L.12 sterling: besides this, he is allowed a certain sum, often three francs per head, for every sheep sold; his board at one and a half francs a day; and a cottage, rent free, for his family. The wages of the inferior shepherd is about L.8 sterling; and he has the same allowance for board as the chief shepherd.

Shepherds dogs.

The Pyrenees breed of shepherd dogs are particularly celebrated. They are black and white, of the size of a large wolf, a large head and neck, armed with collars, stuck with iron spikes, so that no wolf can attack them. But bears are more potent adversaries. If a bear can reach a tree, he is safe: he rises on his hind legs, with his back to the tree, and sets the dog at defiance. These dogs are fed entirely on bread and milk. In most parts of France, when it is necessary to catch a sheep, for the purpose of examining it, the shepherd orders his dog to drive the flock round his master, which he does by going round them in a circle, gradually decreasing, till the shepherd takes any one he wants.

Wool.

The average weight of the fleeces of the native sheep of France is about 2½ or 3 lib.; that of the Merinos about 6 lib. The wool of the former, in general, is of an indifferent quality. The wool of Rousillon is the finest; that of Narbonne is nearly as fine, but more cottony, and of a shorter staple. The wool of Bezieres is next in quality; that of Pesenas, in Languedoc, on the side of Montagnac, is somewhat less fine. The wool of the sea-coast is heavy and coarse: the wools of the mountains of Montpellier and De Somieres are of three sorts; the first equal to the wool of Pesenas, the second less fine, the third very coarse. The wool of Berry is fine; that of Rheims inferior. The number

Statistics.

of sheep in France is estimated at 30,307,728: the total of the wool they yield may be rated at 106,770,000 lib.

Goats. Pigs.

There are a vast number of goats in France, principally, of course, in the mountainous districts. Pigs are chiefly fed in the neighbourhood of woods, or where grain abounds, as Normandy, Champagne, Limosin, &c. They are also fed on acorns; and, in the Limosin, on chesnuts.

Poultry.

Immense quantities of poultry are kept in all parts of France; to such an extent, indeed, that it is a question whether there is more weight of mutton consumed, or of poultry. They are of an excellent quality. Great pains are taken in rearing and fattening them. In French Flanders, as well as in other districts, they are fed with the flour of buck wheat, or rye, or potatoes: their food is frequently changed; and the vessel into which their meat is put is washed with hot water after every repast. After feeding, they are kept in darkness till the next meal. In some parts, what are called *vermiculaires* are expressly kept for them; that is, places in which worms for their food are collected and preserved. Capons are fattened in many parts of the kingdom: those which are fattened at Barbezieux, a town in the department of the Charente, are so much esteemed, that they are sent to Paris for those who keep the most delicate tables.

Honey and wax.

Narbonne honey is much celebrated, but it is not the produce of the neighbourhood of that place; at least it is seldom to be procured there: what is so called is more commonly, as well as much more abundantly, procured at Perpignan. The bees wax of Champagne, Normandy, Sologne, Languedoc, Auvergne, and Brittany, is esteemed the best. Bleaching wax is a business of importance in France. The yellow wax of Brittany bleaches with the most ease, and becomes a beautiful white: it is principally bleached at Chateau Goutier, about eight leagues from Angers. By some, this is esteemed the very best in the kingdom; by others, that of Champagne is preferred. The wax of Amboise, and of Chaumont near Troyes, is of an inferior quality; and that made at Rouen is esteemed the worst, on account of the large quantity of suet they add to it. At Montpellier, there is a large manufacture of bees wax, and the process is conducted with great attention and skill.

Woods and forests.

The forests of France are numerous and extensive; and as they have always been of great importance, both on account of the fuel they supply, and of their application to other purposes, many calculations and conjectures have been made with respect to the surface which they cover. The Marquis de Mirabeau represents them as 30,000,000 arpents; in this opinion M. Malpart coincides. By the author of the *Credit National*, they are reckoned so low as 6,000,000 arpents. Mr Young endeavours to determine this fact by two methods; by the maps of Cassini and by the consumption of the people. By the first method, he makes the extent of wood about 19,000,000 arpents, or one-seventh of the kingdom; by the other method, he finds, that the quantity of wood is about 20,800,000 arpents; the mean of the two results which he thus obtains is 19,850,515. We have already observed, however, that his estimate is too high, at least it is above that of the committee of the first National Assembly, which reckons the wood only at 14,000,000 arpents. Mr Young, in his calculation, reckons the annual value of the woods to be about 14 millions sterling, the rent being taken at 12s. per acre.

Some of the forests are very extensive, particularly those of Orleans, the Ardennes, and Fontainebleau. The forest of Orleans lies to the north of that city, and of the river Loire; it contains several plains and villages in it; its whole length is upwards of 15 leagues; but it is of unequal breadth, in some places seven or eight leagues, in others only two or three. It contains great variety of timber, such as oak, elm, aspens, fir, &c. Before the Revolution, the value of the timber annually felled in this forest, amounted to 100,000 livres: the profit was part of the appanage of the Duke of Orleans. It was formerly infested by numerous troops of banditti; and it is still the haunt of immense numbers of wolves. The forest of Ardennes, in the time of Cæsar, was the largest in Gaul; it began on the banks of the Rhine, and extended to the very borders of the Rhone, that is to say, the diocese of Rheims in Champagne. In another place he says, it extended from the banks of the Rhine, and the country of Treves, to that of the Nervii, that is Hainault, Cambresis, and French Flanders, comprehending 50,000 paces in length. This forest has been cut down in a great many places, especially towards its extremities: however, it still extends over the greater part of the Duchy of Luxemburg, in the southern part of the bishopric of Liege, and of the province of Hainault, and of the northern part of Champagne, though with several interruptions. It was formerly renowned for events of chivalry. The forest of Fontainebleau, anciently called the forest of Biere, contains 26,424 acres of ground, reckoning many empty places, where the trees have been cut down.

Statistics. Forest of Orleans. Of Ardennes. Of Fontainbleau.

The wood of France may be divided into six classes: 1. For ship-building. 2. For the use of house carpenters. 3. For the construction of carriages. 4. For joinery. 5. For vine props. 6. For fuel. Oak is chiefly used for the first class; for the second, oak, fir, linden, and aspen trees; for the third, ash, oak, maple, and especially elm; for the fourth, fir, beech, elm, pear tree, apple, cherry tree, cornil tree, aspen, poplar, linden, &c.; for the fifth, osiers, and branches of different trees; that destined for fuel is divided into new and old, and is distinguished by the names, *bois perdu*, *bois carnard*, and *bois entrain*. The cork-tree flourishes on the French side of the Pyrenees, and produces very fine cork-wood.

National forests.

Under the old government, the *national* forests embraced 3,000,000 arpents, and gave about 12,000,000 franks to the royal treasury. By the Revolution, all the forests formerly held by the corporate bodies and the emigrants were annexed to those of the state, which thus were increased to upwards of 4,000,000 arpents. These, added to the forests in Belgium, and on the left bank of the Rhine, in the year 1806, yielded rather more than 70,000,000 francs, according to the budget for that year. All forests above 300 acres were also added to the national domains, and declared inalienable. In the year 1800 the national forests were thenceforward exempted from the land tax. The Revolution did not abolish the arbitrary laws under which the private proprietors of woodlands laboured. According to these laws, the government appointed persons, who were proper judges of ship timber, to examine all the woods, and to mark such trees as they deemed fit for their purpose, after which the proprietor durst not lay the axe to the roots of them. Besides, no individual proprietor of woodland could cut down his timber, or clear his land, under a heavy penalty, without making, six months previously, a declaration of his intention to one of the conservators, whose report determines the government either to grant or refuse permission to that effect.

To this general account of the woods in France, we shall add some short notices of such trees as are sources of national wealth, independently of the timber which they afford, as an appropriate introduction to our account of the vine-husbandry, and the wines of France.

Turpentine tree.

The fine turpentine tree is found in the southern parts of France, as well as in the isle of Chio, and in the Indies: the juice is the Chio, or Cyprus turpentine of the shops. Considerable quantities of turpentine are also made in the vicinity of Strasburg, from the silver fir; it is known by the name of Strasburg turpentine.

Beech oil.

Beech oil, drawn by expression from the *mast* of the beech tree, after it has been shelled and pounded, is very common in some parts of France, especially in the department of the Aisne, and is used instead of butter. After the oil has been extracted from the mast, the *marc*, as it is called, is also used for food, in various ways; sometimes simply as the extraction leaves it, in which state it is also given to poultry, pigs, oxen and cows; or as flour, being ground in a flour-mill and boutted; or as a kind of cheese, (fromage,) in which case, as it comes from the press, it is moistened with milk, and put into moulds. In Burgundy and Franche Compté, the *marc* of walnuts is made into this kind of *fromage*, after the oil is extracted from it. Walnuts are grown very extensively in France, and a great deal of oil is made from them.

hesnuts.

Chesnuts abound in France, particularly in the Limosin, where the land is almost every where covered with chesnut trees. The fruit serves for food to the country people, but not, as has been asserted, reduced into flour to make bread. Their manner of preparing chesnuts for food is as follows: they take off the first peel or rhind, when they are dry, then they boil them a little, to take off the second peel; and afterwards they boil them entirely, to reduce them into a kind of pap. Thus prepared, they are said to afford a pleasant and nourishing article of food to the peasantry of the Limosin, and other parts of France.

per rub.

The caper shrub grows in great perfection in the southern provinces, especially in the vicinity of Cuges, between Aubagne and Toulon, where an extensive valley is wholly devoted to the culture of them. The caper is not suffered to grow here, as it does in many places, into a bush; but is made to creep on the ground in long runners; and being cultivated only for the trade, is never left to flower, it being the little bud of the flower that is used for pickling. The fruit also, which resembles a very small gherkin, is pickled; but these have the name of *cornichons*, the French name for gherkins: it is the flower-bud which has the appellation of capers. When suffered to flower, it is a very beautiful shrub.

nge

The islands of Hieres, not far from Toulon, were formerly famous for their orange groves. In the year 1565, Charles IX. visited these islands in a progress he made through the south of France: he was accompanied by the young King of Navarre, afterwards Henry IV. and the Duke of Anjou; and there was then an orange tree so large, that these three royal personages, taking each other by the hand, could but just encircle the stem: it had produced in one year 14,000 oranges. But the climate even of the south of France, is not steadily warm enough for this fruit; the severe winter of 1789 killed every tree in the Hieres, down to the roots; and the trees at present there are only such as have shot up from their roots. Most of the oranges of Hieres are sent to Paris. In these islands, and in some other parts of the south of France, the lemon, citron, date, and pomegranate, are not uncommon; the lime is also cultivated, especially in Provence.

Almonds.

The trade of almonds carried on in France is considerable, both on account of their oil, and the large quantity of them used in Lent, either shelled or unshelled: a great quantity of the sweet almonds are used in sugar-plumbs, and of the bitter ones in biscuits, confectionary, &c. The grocers and druggists of France have both sorts from the provinces in the middle and south of France, especially Provence, Languedoc, Tourraine, the county of Venaissin, Avignon, &c. The best are those of the county of the Venaissin; those from Chiron in Tourraine are the worst. The environs of Aix are particularly noted of all parts of Provence, for the abundance of almonds they produce: they are an uncertain produce; a frosty night will sometimes come on, while they are in blossom, which is commonly about the end of January, and in a few hours the greatest part of the crop will be destroyed. At the time when the almonds are gathered, it is a curious sight at Aix to see the women sitting at their doors cracking them for the merchants. The shells being an excellent article of fuel, great interest is made to get the almonds to crack, which is paid by having the shells: a certain measure in the shells is expected to produce a certain measure without them. The person cracking them has a basket of fruit on one side of her, and another basket on the other side to receive them when cracked: she has a flat piece of stone on her knee, and a bone with a knob to it in her hand; and laying the almond on the stone, she strikes it with the bone, which seldom fails to crack it at the first stroke: it is then thrown shell and all into the receiving basket, and when that is full, the almonds are emptied out upon a large table, and the kernels picked from among the shells. The whole process is performed with wonderful dexterity and rapidity.

Figs.

Figs are another important article among the productions of Provence, as well as of several other districts of the south of France. The most celebrated is a very small green, or white fig, as it is often called, which grows only in the territory of Marseilles, whence it takes the name of the fig of Marseilles. Brignolles in Provence, a town about thirty miles from Marseilles, is one of the most famous places in the kingdom for the dried plums, which are so well known by the name of French plums. Prunes, or St Catherine's plums, constitute a lucrative branch of traffic, almost exclusively carried on at Tours and Chatelherault. These prunes are gathered at La Haie, Sainte Maurevaux, Maudion, &c. They are prepared with the greatest care at the places where they are grown; and sent to the merchants of Tours and Chatelherault, who supply every other part of France, as well as foreign countries, with them. The grand purchases of this fruit are made at the commencement of the new year, and of Lent: during the latter season, the demand is particularly great at Paris, and in other large cities and towns in France. Dried plums of excellent quality are also prepared at Agen, Cutroen, Toulouse, and Bourdeaux.

Plums.

Mulberries.

Mulberries succeed best in the olive climate of France; Tours being the only place north of the maize climate, where they are cultivated for silk with any success; the spring frosts being fatal impediments to their culture in the central, and even sometimes in the southern districts of the kingdom. Considerable experiments have been made for introducing them into Normandy, &c. but without success. In proceeding from Paris to the south, they are not met with till we come to Caussade near Montauban; there are a few at Auch; and even at Tours, the district in which they are grown is of small extent. Before the time of Henry IV. the mulberry trees had been propagated for silk worms only in the Lyonnois, Dauphiny, Provence, and Languedoc; but that king carried them as far north as Orleans; he also planted them near Paris, and attempted to breed silk worms at the Thuilleries, Fontainebleau, and the castle of Madrid, but without success. In the Lyonnois the white mulberry succeeds extremely well, and a great many silk worms are reared: the worms are kept in houses, and the leaves carried to them. It is a singular spectacle to see whole trees stripped of their leaves, and bearing the appearance of winter when other trees are in full foliage. A second crop of leaves, however, comes out, but not with the beauty and luxuriance of the first; and they are often gathered to give to the sheep and cattle when other food fails. The white mulberry tree bears a more delicate kind of leaf than the black, for which reason they are always given to the silk worms, as the silk produced from them is of a much finer quality: the fruit is vapid and good for nothing. The leaves are purchased and paid for according to the size of the tree, by those who keep silkworms, but have not mulberry plantations of their own.

Olives. The limits of the olive climate have been already defined: They comprehend a very small portion of the south and south-east of the kingdom. In France, there is a great difference in the quality of the oil produced from them; that of the territory of Aix is reckoned the finest. Here the trees are very small, commonly from about eight to fourteen or fifteen feet in height. About Toulon and Hieres the trees are taller, but the oil is of a less delicate quality. The tree resembles a pollard willow in its general appearance, and is by no means either beautiful or picturesque. The fruit is gathered green for making the oil, but if left to ripen, it becomes almost black. When they are preserved, or pickled, they are salted first for a few days, and then put into jars with oil and vinegar. In most houses in Provence lamps are used in the kitchen instead of candles; and among the lower classes they are used universally. Olive oil is used in them. The wood of the olive tree makes excellent fuel when a brisk fire is wanted; but it partakes so much of the greasy nature of the fruit, that while it burns very bright, it also consumes very fast. The time of gathering the olives is soon after the vintage. In the hard winter of 1789, so many olive trees wese destroyed by the frost, and during the Revolution so few young trees have been planted, that Aix, which was the principal seat of the commerce in oil, has almost entirely lost this its first and most lucrative branch of trade; and as these trees are many years in coming to perfection, this loss is not likely to be soon compensated.

Vineyards. As there were aides and customs levied on the consumption and export of wine previously to the Revolution, it might have been supposed that the quantity of vineyards in the kingdom might have been estimated with a tolerable degree of certainty, yet there is an amazing difference of opinion on this subject. M. de Trone, author of a work on the provincial administration of the taxes, is of opinion, that their extent is 1,600,000 acres. In this calculation M. Mirabeau coincides; but the author of *Credit National*, who published only one year afterwards, calculates the quantity at 18,000,000 arpents. M. Lavoisier supposes the produce 80,000,000 livres. The economists in the *Encyclopedie*, make the annual produce 500,000,000. This, at an average produce per acre of 175 livres, would give 2,857,142 acres. Mr Young, after considering these and other calculations, gives it as his opinion, that the vine is cultivated on an extent that constitutes nearly the twenty-sixth part of the territory of France, or about 5,000,000 of acres; and that grapes form about one-sixth part of its produce.

The vine is cultivated on all kinds of soil: On the noble and fertile plain of the Garonne; on the richest lands in the vale which extends from Narbonne to Nismes; in the vales of Dauphiny and the Loire; and, in short, on every sort of land in the wine provinces. They are, however, perhaps most generally planted on rocky and inferior soils.

Cultivation of the vine. The general routine of cultivation is as follows: The vines are planted promiscuously, three or four feet, or two and a half from each other. In the middle of January they give the cutting, *taille;* in March they dig the ground; in April and May they plant the *provins;* in June tie and hoe the *seps,*—they are tied to the props with small straw bands,—the hoe which is used is crooked; in August hoe again; in October, or if the season has been favourable in September, the vintage takes place. To plant an arpent of vines costs in all 50 Louis d'or. There are 8000 plants on an acre, 2400 seps. The props cost 500 livres; to keep up the stock of props 30 livres annually. It is three years before the vines bear any thing, and six before the wine is good. The amount of labour per acre is about £2 : 12 : 6. The net profit varies from 7 to 10 per cent. Great attention is paid in the choice of the bunches, and in freeing every bunch from each grape that is the least unsound. Sixty women are necessary to gather the grapes for four pieces of wine. Such is the general outline of the culture, &c. of the vine in France. The variations from this mode will be afterwards noticed.

Champagne wines. I. The province of Champagne, which is now divided into the departments of the Marne and the Higher Marne, has long been celebrated for its vineyards. In this district there are two kinds of wine; the white wines, called *Riviere de Marne* wines; and the red wines, called *Montagne de Rheims* wines. The white wines are produced from vineyards situated in the valleys, and upon the sides of the hills in Epernay, Dizy, Avenay, Cramant, &c. It is a singular circumstance, that the estate of Cumieres, in the midst of so many vineyards celebrated for white wines, and under the same exposure, produces red wines only. The country producing the fine white wine, is all contained in five leagues length. Among all the vineyards on the Marne, the cantons of Hautvillers, Marcueil, Cumieres, and Epernay, are the most advantageously situated: They extend along the Marne; and it is remarked, that the quality of the wine falls off in proportion as the vineyard is distant from the river. South exposures on the banks of this river produce excellent white wines. The slope which overhangs Rheims is divided according to the quality of its wines: Of these, the wines of St Thierry are the most celebrated; but the wine properly called *Clos St Thierry,* which is produced in the archbishopric of Rheims, is the only wine which unites the rich colour and flavour of Burgundy with the sparkling lightness of Champaigne. *Clos St Thierry* holds the same rank among Champagne wines, that *Clos-vougeot* does among those of Burgundy. Sillery wines, once so famous, were in a great measure composed of the wines produced in the territories of Vermay, Mailly, and St Basle. They were made by a particular process by the Marshal D'Estrees, and for this reason were long known by the name of *Vins de la Mareschal*; but at the Revolution this estate was divided and sold.

Details of the culture of the vine.

In Champagne, and indeed in all the vine districts of France, the south and the east exposures, and the middle grounds, are preferred. In general, throughout this province, the soils proper for vines rest on beds of chalk: they are planted in November or December; the plants are inserted into turfs, or in *longuettes*. Grafting is not in general use. A good plant will last 50 or 60 years. There is not much variety in the grapes of Champagne; the black are generally preferred to the white. There are whole cantons, however, where there are very few black grapes, and yet their wine is in high estimation. In this province, the vine is pruned about the end of February or beginning of March. It is never allowed to rise higher than a foot and a half. At the end of March, or beginning of April, when the thaws have softened the ground, the hoeing commences. The following is the remainder of the routine practised in the vineyards of Champagne; after the cutting in February or March, and the hoeing in March, as already mentioned. 3. They are pruned in April or May. 4. Tied or propped up in the same months. 5. The next operation is the first trimming for the shoots. 6. Pared and tied in June. 7. Second trimming in July. 8. Third trimming in August. The vintage is in September or October.

Mode of making white wine.

Many precautions are necessary in making white wine; steeping before pressing makes red wine, the grapes being allowed to remain in the vessels till the first fermentation has begun in the colouring pellicle of the fruit. In making white wine, great care is taken to keep the grapes from the sun; they are conveyed home in panniers, covered with cloths, from which they are not emptied into the press till after sun set: these precautions are necessary to prevent fermentation. From twenty to forty panniers are put into the press at a time; the contents of two panniers produce half a piece of wine. Forty panniers yield nine or ten pieces of white wine, and each piece contains 200 bottles. The fruit is pressed by three successive and rapid turns of the screw in some districts, and by two only in others. The whole of the operation should be finished in less than an hour. When the three pressures have been effected, the wine produced from the juice is called *vin d'elite*, or choice wine; after this *vin d'elite* is extracted, the remaining juice is pressed out by another turn of the screw; this is called *premiere taille*, the first cut, and is often added to the *vin d'elite*. Another pressure is given at a subsequent period, and the wine is called *deuxieme taille*, or *vin de tisanne*; lastly, a poorer kind of wine, called *vin de rebechage*, is produced by repeatedly pressing the husks till they are perfectly dry. The white wines are clarified with isinglass; they are generally bottled in the month of March. About the middle of August, the fermentation in the bottles begins, and frequently there is a loss by the end of September of from five to ten per cent. by the bottles breaking. When the white wines deposit a sediment in the bottles, very minute care is requisite to extract it. The wines of Champagne, after being put into circulation, preserve their good qualities for ten years; but when they are kept in the cellars of their native province, which are superior from the nature of the soil, (being dug out of beds of chalk), they will continue good for 20 or 30 years.

Produce of the vineyards.

The price of an acre (100 rods and 22 feet to the acre) of the best vineyard ground in Champagne, varies from 2000 to 6000 livres; the vineyards at Ay selling as high as 6000 livres. The price of an acre of the second quality varies from 1000 to 3000 livres. The ordinary expence of cutting, hoeing, tyeing, and pruning the vines, is 80 livres the acre; of occasionally propping such as have fallen, 60 livres; of props, 16 or 18 bundles, 50 in each bundle, 30 livres; dung and carriage of the vines, 42; five puncheons for the produce of an acre, 50 livres; expence of gathering, pruning, &c. 46 livres; making a total expence per acre of 308 livres. With respect to the produce of an acre of vineyard in Champagne, it is generally understood, that taking the average of 10 vintages, five pieces or puncheons of wine are obtained from every acre; three of these are of the first quality, or choice wines, and two of them are ordinary wines. Valuing the three puncheons of the best wine at 150 livres each, and the two others at 50, the total produce will be 550 livres; from which must be deducted, besides 308 livres for labour, &c. the expence of bottling, cooperage, and fining, 30 livres for the best wines, and six for the inferior; the annual interest of the money laid out in the ground, 100 livres; taxes, &c. 72; making in all, with the labour, 516 livres; which being deducted from 550, leaves 34 livres as the net produce of an acre of vineyard in Champagne, on an average of years. This net produce, however, it is very difficult to fix, as the wines of Ay, Haut Villiers, Epernay, and Pierry, frequently sell for 300 or 400 livres a piece, while some of the other wines do not bring more than 90 or 100 livres.

Red wines.

It has already been mentioned, that this province is equally famous for its red wines, and some parts of the process by which they are made have been hinted at. To make red wine, the black grapes in general are only picked and gathered. The juice is allowed to ferment, and the degree of fermentation is ascertained to be advantageous, when a lighted candle cannot be held over the tub without going out. When the fermentation has entirely ceased, the puncheon is hermetically sealed. About the end of December, and if possible in dry weather, the wine is drawn off. About the middle of May, it is again drawn off. A puncheon of red wine contains 240 bottles. In general, the red wines of Haute Montagne are bottled in the month of November, *i. e.* 13 months after the vintage. The wines of St Thierry can remain three or four years on their lees. The best red wines of Haute Montagne, will keep in bottles in good cellars for six, eight, ten, or twelve years. These cellars (already alluded to) are from 25 to 40 feet in depth. Their temperature is generally five degrees of Reaumur below that of the atmosphere; the variations are seldom above half a degree.

The cost of an acre of vineyard, for red wine of the best quality, varies from 900 livres to 2000. That in Haute Montagne bears the highest price; the second class sells from 300 to 900 livres. The annual expence of cultivating an acre of red wine vineyard, including the expence of vintage and of pruning, is about 200 livres.

Such are the general details of the culture of the vine in Champagne. There are many vineyards, however, and particularly in St Thierry, where the greater part of the vines are always raised to the height of about five feet, and supported by props of oak six feet high, and an inch in diameter.

The following are the classes of the white and red wines of Champagne:

Statistics.

Classes of Champagne wines.

White Wines.	Red Wines.
First class.	
Ay.	Verzieto.
Haut Villiers.	Versinay.
Pierry.	Borezy.
Cramant.	Faissy.
	Cumieres.
Second class.	
Avernay.	Mailly.
Epernay.	Damenay.
Le Meuil.	Epernay.
Avis.	Rilly.
Oger.	Montbret.
	Ay.
	Pierry.
Third class.	
Tonnere.	Joigny.
Chaldy.	Tonnere.
Ludes.	Chamery.
Sadu.	Ville Domage.
Troispuits.	Parguy.
Villiers.	Safflecomte.

The first class comprises those wines which have long been considered as luxuries at the French, English, and Dutch tables; the second class comprehends wines, which are not much inferior in flavour and quality to those of the first class; in the third class, are comprised the wines most commonly used in France.

As many of the details respecting the managements, &c. of the vineyards and wines of Champagne, are applicable to the other wine districts of France, we shall be more concise in our observations respecting them.

Vines of the Bordelais.

II. The vines in the Bordelais, and generally in the higher Guienne and Gascony, are not suffered to lie on the ground like those of Provence and Languedoc, but are supported by poles, something like hops in England. The wines produced in this district, are distinguished into Medoc, Haut Brion, Valence, St Emilion, De Grave, &c. The best Medoc wines, are Lafitte, Latour, and Margoux. Those of *Vins de Grave*, are Haut Brion, Haut Valence, Morignac, Pessac, Laugon, Villenave, &c. The *Vin de Laugon*, so called from a small town near which it is made, is reckoned the best of all the white wines of the Bordelais, which are included under the general name of *Vins de Grave*, from the sandy and gravelly soil in which the vines grow. It has very much of the claret flavour. There are other sorts in different districts, such as St Julien, St Manubert, Pouillac, St Laurent, Ludon, Maçon, &c. Those which hold the first rank among the white wines, are Carbonnieux, Serons, Barsac, Prigniac, Saulerne, Baume, &c. Of the white wine exported from this district, the total annual amount may be from 85,000 to 90,000 tons. From 20,000 to 25,000 tons used to go to the French colonial settlements in the East and West Indies. About an equal quantity was exported to Normandy and Flanders. Those that are called crude wines of Medoc, are almost all exported to England. The red wines of Haut Brion, Valence, and in general those named De Grave, are sent to Holland, Hamburg, and the Hanse Towns. The best red wines of Montferant go to Holland. Those of inferior quality, used to go to the French colonies, or the western departments of the kingdom. The white wines of Grave, Carbonnieux, Martillac, Loegnau, &c. are sent to Denmark, Sweden, and the Baltic; but the best of these go in bottles to Paris. The red wines of St Macaire, formerly went in part for the use of the French navy, partly to Brittany and Normandy, the rest to Bremen and Lubec.

Statistics.

Vines of Provence and Languedoc.

III. Throughout Provence and Languedoc, the *souche*, or stem of the vine, is never suffered to grow higher than about two feet from the ground. The shoots of the year are always cut down to the stem soon after the vintage. The new shoots put forth every year, are of an amazing length. The grapes grow in a large cluster round the roots of them, and are shaded by the shoots as by an umbrella. The cuttings of the vine are made into faggots for fuel. The vintage begins about the middle of September. The ordinary wines of Provence are not held in much estimation; but there are some of a superior quality, the Muscat wines in particular, which are little inferior to Frontigniac. Roquevarre, not far from Nains, is famous for Muscat grapes. Great quantities are dried for raisins. A wine is made in many parts of Provence, called *Vin cuit*. It is not the produce of any particular kind of fruit, but made from any common white grape, the juice being boiled after it is pressed, till it is reduced about a fourth, which gives it a richness and sweetness, not to be obtained by any other process. The Muscat wines are boiled in like manner, as are also all the sweet wines. The process of wine-making is very negligently performed in Provence in general; there is no selection of grapes; red, white, ripe and unripe, are pressed promiscuously together. The method of pressing is very rude and simple. A man, and commonly two or three children, pull off their shoes and stockings, and jump into the vats, where they trample on the grapes till all the wine is pressed out. The only sort of grape used for drying, besides the Muscat, is a large white grape called the Panse. Four or five bunches of the fruit are tied together, and then dipped into a cauldron of ley of wood ashes and water, as it is boiling over the fire, till the grapes look streaky. Without this process, they would turn black and wither when laid out to dry, instead of retaining their sweetness and moisture. After the dipping, they are hung upon a line for 24 hours, and then separated, and spread upon a sort of hurdle made of reeds, which is laid out in the sun all day, but taken in at night, to protect the fruit from the dew. An excellent sweetmeat is made in Provence, and in other parts of France, by boiling down the juice and pulp of the grape, freed from the skins and stones, till it becomes a rich syrup, when slices of melon, lemon, pears, &c. are preserved in it. It goes by the name of *confiture raisinée*.

Of Burgundy.

IV. The province of Burgundy, in the opinion of many, produces the choicest of the French wines. The best is made at Baom, Nuitz, Romanée, Premeau, Chambertin, Belz, Coulange, Chassane, Volenay, Maçon, and Clos-Vougeot.

Of other parts of France.

V. Wine is also the produce of many other parts of France. A great deal of the wines made in the Beaujolais, are sold under the name of Macon. The wines of Anjou and Orleannois are thick and heady. Auvernat, commonly called Casse Taille, is made at Orleans, and is a full good wine. Another Orleans white wine is Genetin. Poitou produces a tolerably good white wine, which resembles Rhenish. Hermitage is the produce of a vine, which is grown upon the banks of the Rhone, between Valence and St Valliere. Near this also, the *Cote roti* is made. It takes its name from the hill on which the vines grow, being fully exposed to the warm rays of the south sun, which contributes so much to the excellence of the wine. The average yearly produce is nearly 1000 hogsheads. The true *Vin de Cahors*, which has a great reputation, is the produce of a range of vineyards, very rocky, on a ridge of hills to the south of Cahors, and is called Vin de Grave, because growing on a gravelly soil. The wine of Condrieaux, a small town in the Lyonnois, on the banks of the Rhone, about seven leagues from Lyons, is very much esteemed. The original plants from which this wine is made, were, according to tradition, brought from Dalmatia, by order of the Emperor Probus.

Luscious wines.

Luscious wines and liqueurs are common in other parts of France, as well as Provence, of which those of Crotat and St Laurent are the most esteemed. Frontigniac, a town in the department of the Herault, is remarkable for its excellent muscadine wines. They are the most perfect, and the best adapted for keeping. Lunel, an old town in the department of the Gard, is another place, in the vicinity of which muscat grapes are cultivated in great quantities, the soil being peculiarly suited to them. The muscadine of Lunel is of a more delicate flavour than Frontigniac, but it will not keep so well. The muscat grapes grown here are also dried, and are sent all over Europe. They are called in the country *passerilles*. Aubagne, between Marseilles and Toulon, produces also muscadine wine. The *Malvoisie d'Aubagne*, as it is called, is particularly celebrated. The muscadine of Rivesaltes, a town in the department of the Eastern Pyrenees, is richer than either Frontigniac or Lunel, and comes very near the Cape wine. Bezieres is of a quality inferior to Rivesaltes, Frontigniac, and Lunel. Liqueurs of various sorts are made in different parts of France. Those of Montpellier are most esteemed. In the beginning of the last century, France exported, upon an average of five years, from the year 1720 to 1725, annually wine to the amount of 20,880,200 livres; in 1778, the exportation amounted to 24,570,170; in 1788, to 33,032,100. The Revolution nearly annihilated the exportation of French wines.

iqueurs.

andies.

The brandies made in France, are esteemed the best in Europe. They are distilled in every part of the kingdom where vines are grown; and in the distillation, not only wines of an inferior, but also those of the best quality, are used. The brandies most celebrated, or made in the greatest quantities, are those of Bourdeaux, Rochelle, Cognac, Charente, Isle of Rhe, Orleans, the country of Blesois, Poitou, Tourraine, Anjou, Nantes, Burgundy, Champagne, &c. Brandy is also a great article of trade at Montpellier. It is of a milder quality than most of the brandies of the south of France, and therefore better adapted for making the liqueurs, for which Montpellier is so celebrated. Of all the French brandies, those of Nantes, Cognac, and Poitou, which are nearly of the same quality, are the most esteemed, because they have a finer taste, and are stronger. The English, Dutch, Flemish, and Hamburgers used to take off the greatest part of these brandies. The brandies of Anjou, Tourraine, Orleans, which are not of so good a quality as those of Nantes, &c. are most commonly sent to Paris, and into Flanders. In the beginning of the last century, the value of the brandy exported, amounted annually to 5,852,960 livres; in 1778, to 4,660,221; in 1784, to 11,360,200; in 1787, to 14,689,600; and in 1788, to 14,657,300.

gar.

Vinegar is made in Provence, Guienne, the Orleannois, Anjou, Aunis, Brittany, &c. The Orleans vinegar is esteemed the best. The flavour of the vinegar made in Provence is also good; but being of a red colour, from the hue of the grapes from which it is produced, it has a singular appearance to a person unused to it. The exportation of vinegar in the beginning of the last century, amounted annually to 34,400 livres; in 1778, to 141,893; in 1784, to 124,400; in 1787, to 130,900; and in 1788, to 201,700.

Cider.

Cider is made in most of those provinces, the climate of which is not favourable to the grape. Normandy is particularly celebrated for this liquor, where they also make brandy of it.

Horticulture.

We shall conclude this Chapter with a few words respecting French horticulture. The fruit gardens at Montreuil are a curious instance of the accumulation of capital in a small space: These gardens are said to be worth £400 sterling an acre. All the occupiers are proprietors. The environs of Lyons are celebrated for their excellent artichokes: They are carefully conveyed in great quantities to the tables of the rich all over the kingdom. Vegetables for the table are also cultivated in great perfection in Provence, and particularly about Aix. The country for some distance without the town, especially on the south side, is a continued scene of kitchen garden. The vegetable for which they are most famous, is what they called *cardes*: a plant very much resembling the artichoke, but not growing to a head in the same way. The roots always make part of a Christmas dinner. Aix is so famous for them, that at this season presents are sent of them from thence all over the country. The salads of Aix also, particularly in winter, are esteemed uncommonly good. The tomato or love apple, the *aubergine* or fruit of the purple egg plant, gourds, and capsicums, are likewise much cultivated in the gardens of Provence. The inhabitants of Roscoff, a town on the northernmost point of the department of Finisterre, particularly apply themselves to the raising vegetables for the table; and in this they are so eminently successful, that Brest, Morlaix, and several other towns, draw their supplies almost entirely from them; and they are sometimes sent as far as L'Orient and Quimper, in the southernmost districts of the department. Cauliflowers, brocoli, cabbages, turnips, asparagus, and artichokes, are especially produced here in amazing abundance, and of an excellent quality.

But though France has made great advances in the useful branch of horticulture, she is far behind in the ornamental: The strait avenue, the terrace, and the parterre, with formal basons, and jets-d'eau, are still the only objects which, in the opinion of the generality of Frenchmen, can constitute real grandeur and beauty in a garden.

CHAP. V.

Manufactures of France—Historical notices of them—their Situation and State previously to the Revolution—Effects produced on them by that event.

The consideration of the agriculture of France has detained us long. The account of the manufactures and commerce of that kingdom will not occupy nearly so much space; for France always has been, and probably always will be, more distinguished by the productions of her soil, than by the productions of her manufacturing and commercial industry.

Manufactures.

In considering her manufactures and commerce, we shall, in the first place, present some historical notices respecting them,—pointing out their origin and their principal eras, so far as they can be ascertained. In the second place, we shall give an account of their state and condition previously to the Revolution: And, lastly, we shall notice, in most cases briefly and generally, but in some instances more particularly, the effects which that event has produced upon them. We are induced to dwell more fully on their state previously to the Revolution than since it occurred, from two considerations: In the first place, even if their state since could be accurately and impartially ascertained, it would afford no just and permanent picture of them, on account of the great fluctuations, or rather the great depression, to which the Revolution must have subjected them; but, in the second place, it is impossible to gather correct details regarding the manufactures and commerce of France as they now exist; for, although annual exposès have been published, yet the falsehoods and exaggerations which they notoriously contain, peremptorily prohibit us from placing any faith in them. All that we know, in general, is, that by the revolutionary wars the commerce of France has been almost annihilated, and that many branches of her manufactures have been greatly depressed. As, however, her commerce will probably, when it revives, revert into the channels in which it flowed previously to the events which have nearly destroyed it, and as such also will probably be the case with her manufactures, we have deemed it proper to consider more particularly their state previously to the Revolution, subjoining what information we have been able to collect regarding the effects that event has produced on them. And first, with respect to her manufactures:

Historical notices before the time of Henry IV.

I. The earliest notice which we can trace of any branch of the manufactures of France, occurs in the fourth century. It is afforded by St Jerome, in his second book against Jovinian, where he speaks of a manufactory of stuffs which was then at Arras, and which was much esteemed. But the first establishment of the cloth manufactures of that kingdom, a branch for which it has always been greatly celebrated, cannot be accurately traced. That they were extensive and important in the beginning of the 14th century, is evident from some letters which exist from the King of France to the King of England, in which he expresses great anxiety to procure English wool at St Omers and Lisle. In 1346, the King of France attempted to detach the Flemings from the interest of King Edward, by sending them the wool of France at a low price, and obliging his subjects to use no other wool, while their cloth made of French wool was to be procured: Thus offering to sacrifice the woollen manufacture of his kingdom. The next notice we have of the manufactures of France occurs in 1453, at which period some branches of them appear to have flourished considerably. This is evident from the account which her historians give of Jacques Cœur, who, by his loan of 200,000 crowns, greatly contributed to enable the King to expel the English. This merchant, at a time when trade was scarcely known in France, is said to have employed 300 factors to manage his vast commerce, that extended to the Turks and Russians in the East, and the Saracens of Africa, at that period the most remote nations known to the merchants of Europe. His exports consisted chiefly of woollen cloths, linens, and paper, then the principal manufactures of France; and his returns were silks, (which proves that this manufacture was not then established, or at most only in its infancy,) spiceries, &c. Indeed we know, from other sources, that the first considerable and regular attempts to establish the silk manufacture, occurred in the reign of Francis I. in the year 1521. This monarch took great pains to procure workmen from Milan, while he possessed that duchy. In this manufacture the French made a great progress, principally at Lyons, and other parts of the south of France, and soon supplied many parts of Europe with silk goods; yet it was long after this time, as we shall afterwards shew, before she got into the method of raising raw silk from the worms. In the reign of Henry III. some attention was paid to manufactures. At this period they were neither numerous, nor advanced to a state of any perfection. Articles of elegance and luxury were imported from foreign nations, and even such as were of general consumption had not attained beyond their infancy. Leather and parchment, however, were prepared with some dexterity at Troyes in Champagne; and this place was likewise renowned for the goodness of its dyes, in which occupation the inhabitants were principally employed. A manufacture of white paper was established at Brignolles, in Provence, about the beginning of Henry the Second's reign; and there seems to have been others in the kingdom. In the manufacture of iron and steel the French were then very deficient. Their fire arms they procured from Lombardy. Charles IX. indeed, endeavoured to introduce among his soldiers musquets made at Metz and Abbeville, where manufactures of arms were established, but they were so heavy and awkwardly made that the attempt was laid aside. The same monarch brought to Paris, Italian manufacturers, who finished there the morions, or head-pieces, which were manufactured and purchased at Milan. In the reign of Henry III. gunpowder was made in France, but not in sufficient quantity to render the importation of it, as well as of saltpetre, unnecessary. Genoa, in particular, supplied the French with gunpowder.

In the reign of Henry IV.

But the first grand era of the manufactures of France must be fixed in the reign of Henry IV. The monarchs before him had occasionally encouraged particular manufactures; but their encouragement being partial and temporary, and not proceeding from any clear or profound views on the subject, went a little way in the completion of the object they had in view. Henry IV. on the contrary, maturely considered the best means for promoting and cherishing manufactures; and though we can hardly suppose that Sully, who greatly preferred agriculture to manufactures or commerce, entered very cordially into the views of his master, yet there can be no doubt that Henry profited by his penetration and good sense. Before this reign, the silk-worm and mulberry trees had been propagated only in the Lyonnois, Dauphiny, Provence, and Languedoc; and so destitute was France of articles of luxury, that in 1599, Henry issued an edict prohibiting the importation of foreign silks. The inhabitants of the city of Tours had extorted from him this prohibition by their importunities, undertaking to supply all the national demand for silk, as well as for gold and silver stuffs. But they could not perform their engagement; and in 1603, the King was obliged to rescind the edict. Sully entertained great and almost insurmountable prejudices against the silk manufacture, and was impressed with the belief that the climate of France was unfavourable to rearing the silkworm. Henry, however, was not to be discouraged. As we have already mentioned, in 1608, temporary buildings were constructed at Fontainebleau, at the castle of Madrid, and at the Thuilleries, for silk-worms. Mulberry trees were planted in various provinces, in which they had not been previously cultivated, especially in the vicinity of Paris, Orleans, and Tours. The government caused pamphlets on the art of cultivating these trees, and preserving the silkworms, to be distributed. A council of commerce was instituted. In 1605, the king procured silkworms from Valencia in Spain. These measures were successful, so far as they respected the southern and some of the central provinces of the kingdom. But Henry's attempts to rear the silk-worm so far north as the capital proved abortive. Before his death, however, he witnessed the general good effects of his exertions and perseverance. Foreigners began to repair to Lyons, which city was soon enriched by the silk manufacture; and it is expressly stated, that the southern provinces of Languedoc, Dauphiny, and Provence, derived from it, in the course of only seven years from its establishment, greater profits annually, than from the joint produce of their oil, wines, and sweetmeats, the ancient and natural productions of the country.

Henry did not confine his attention and his encouragement to the silk manufacture, though this appears to have excited and retained his warmest interest. Gold and silver tissues, of various kinds, and of exquisite beauty, were manufactured at Paris, by workmen whom he brought from Milan, and induced to settle in the capital, under his immediate protection. The Gobelins tapestry, of such unequalled delicacy, and afterwards so much admired over all Europe, was begun in one of the suburbs of Paris, under the direction of artists from Flanders; but as this manufacture seems to have sunk, and was not revived till a future reign, we shall afterwards have occasion to notice it more particularly. Looking-glasses, in imitation of those cast at Venice, and which had been formerly made in the reign of Henry II. at St Germain, were again undertaken with success at Paris and at Nevers. Earthen ware, white and painted, was fabricated with the same beauty as in Italy. It appears from a passage in Sully's Memoirs, that the art of enamelling had attained, before 1603, a very considerable degree of perfection. Crapes equal to those of Bologna, were manufactured in the castle of Mantes, upon the Seine; and the manufacture of linen, similar to that of the Dutch, was begun. In the suburbs of St Honoré and St James, the lower orders of the inhabitants of Paris found employment; as there were there great manufactories of gilt leather for the furniture of houses. Before this reign, iron had been cut and split by the hand; but mills for those purposes were now established on the river Estampes: and steel, which had been previously procured from Piedmont, began to be manufactured in the suburb of St Victor in Paris. A native of Provence discovered a method of making ropes, and even a kind of coarse linen, with the bark of the white mulberry tree; and an inhabitant of St Germain carried to a perfection previously unknown, the art of making leaden pipes and spouts for the conducting of water. Before this reign, white lead was always imported; but it was now prepared and sold at a moderate price. Manufactures of gauzes, and thin linen cloth, as well as of woollen cloth and serges, were also encouraged and extended by Henry.

Giovanni Botero, an Italian author, who, in 1590, wrote a small treatise on the causes of the magnificence and greatness of cities, represents France at this period as among the greatest, richest, and most populous kingdoms of Christendom. According to him, it contained 27,000 parishes, and 15,000,000 of people; and was so fertile by nature, and so rich, through the industry of its inhabitants, as not to envy any other country. In another place he represents France as possessing what he calls four great magnets, which attract the wealth of other countries, viz. corn, which is exported to Spain and Portugal; wine, which is sent to Flanders, England, and the coasts of the Baltic; salt, made by the heat of the sun on the shore of the Mediterranean, and also of the ocean as far north as Saintonge. The fourth consists of hemp and cloth, "of which, and of cordage, great quantities are carried to Lisbon and Seville, for the shipping; and the exportation of the articles of this fourth class is incredibly great."

In the 17th century.

It might have been supposed, that the civil wars, by which France was convulsed during the 16th century, would have been fatal to her manufactures, or at least would have depressed them for a considerable length of time. This, however, does not seem to have been the case. "I remember," says Brantome, "in the first civil wars, Rouen was carried by storm, pillaged and sacked during several days; yet, when Charles IX. and his mother passed through it, about fifteen or sixteen months afterwards, to their astonishment all traces of that calamity had disappeared, and nothing but opulence was visible."

The *Political Testament* of Cardinal Richelieu gives us some insight into the state of the manufactures of France about the year 1635; and from it, it appears that even then she abounded with the finest and best of manufactures; such (says he) as the serges of Chalons and of Chartres, which have superseded those of Milan. The Turks prefer the French *draps de sceau* of Rouen before all others, except those of Venice, which are made of Spanish wool. Such fine plushes are made at Tours, that they are sent into Spain, Italy, &c.; also fine plain taffeties, red, purple, and spotted velvets, finer than at Genoa. France is the only place for silk serges. Mohair (camblet) is made as good here as in England, and the best cloth of gold, finer and cheaper than in Italy.

In the reign of LouisXIV.

The manufactures of France, however, do not seem to have met with much encouragement from the government during the reign of Louis XIII. The next important era is the age of Louis XIV. His minister, Colbert, was extremely anxious to establish new manufactures in France. The principal of those that were either introduced, or established and extended in this reign, were those those of Sedan, Abbeville, the Gobelins, and the glass manufacture of St Gobins.

Establishment of the cloth manufacture at Sedan.

1. The manufacture of fine cloth at Sedan, both black and coloured, which has been so long celebrated, owes its birth and perfection to Nicolas Cadeau. This person was a native of France, who had become acquainted with the mode practised in Holland of manufacturing fine cloths. In 1646, he entered into partnership with John Binet and Yves de Marseilles, two rich merchants of Paris; and, in the same year, they obtained a patent for the manufacture, for twenty years, of woollen cloths, black as well as all other colours, that should be made after the fabric and manner of Dutch cloths. For their further encouragement, they had each a pension of 500 livres for life, and their children were ennobled in France; their foreign workmen declared to be denizens of that kingdom, free from being quartered on by soldiers, and from all taxes and excises. The directors were also allowed 8000 livres annually, for carrying on the manufacture during the term of the patent.

At Abbeville.

2. The exclusive privilege of Cadeau and his partners was on the point of expiring, when Josse Vanrobais, a Dutch merchant, made a proposal to set up a new manufacture of fine cloths at Abbeville in Picardy, in imitation of those of Spain and Holland. This proposal was immediately agreed to by Colbert, who

brought Vanrobais from Holland, granted him a patent, and settled him and his workmen at Abbeville. By this patent, which was dated in October 1669, Vanrobais obliges himself to set on foot thirty woollen looms, with as many fulling-mills as should be necessary, and procure fifty Dutch workmen to be employed in the manufactory. Encouragements and privileges, similar to those granted to Cadeau, were bestowed on him. In 1681, having punctually fulfilled his engagements, he obtained a renewal of his patent for fifteen years, on condition of setting up fifty looms instead of thirty. In 1698, a third renewal was granted for ten years, to the brothers and sons of the projector, who had now eighty looms in their manufactory. In 1708, the looms exceeded a hundred; and there were about six hundred men, women, and children, employed upon the spot, in picking the wool, winding, warping, weaving, shearing, &c. At this time, a fourth patent was granted, in which the King gave permission to all noblemen to enter into partnership, without derogation to their titles or honour; and, to encourage the sale of these and other French woollen goods in Turkey, he advanced money to the merchants of Marseilles out of his treasury, to be repaid after the return of their ships from Turkey.

Of the Gobelins tapestry.

3. We have already mentioned, that Henry IV. established a manufacture of tapestry in the suburbs of the metropolis, but that it does not seem to have succeeded. This manufacture was revived with more success by Colbert: it obtained the name of *Gobelines*, because the house where the manufacture is carried on was built by two brothers, whose names were Gobelines, who first brought to Paris the secret of the beautiful scarlet dye, which has preserved their name, as has also the little river Bievre, upon whose banks they first settled. Colbert purchased the ground from these brothers, for the purpose of establishing there a manufacture of tapestry, similar to that of Flanders. He was particularly anxious on this point, in order that he might procure suitable furniture for the royal palaces, which he had rebuilt and ornamented, particularly the Louvre and Thuilleries. With this view, he collected together some of the most able workmen in the kingdom, in all sorts of manufactures and arts, particularly painters, tapestry-weavers, engravers, goldsmiths, and workers in ebony. The tapestry-weavers were procured from Flanders; separate superintendants of the *raised* and of the *smooth* tapestries were appointed; and another Fleming was vested with the management of the wool-dyeing department. The manufacture of tapestries commenced in 1663, but did not flourish till 1666, when it was endowed with many privileges, and denominated, in the edict, the Royal Manufactory of the Crown Furniture. At length, the celebrated painter Le Brun was appointed chief director of the Gobelin manufactures, to which he communicated that beauty and grandeur, which his admirable talents were so well calculated to introduce. The tapestries were brought to a high state of perfection during the administration of Colbert and Louvois. During the administration of the fomer, Alexander's battles, the four seasons, the four elements, and the history of the principal acts of Louis XIV. from his marriage to his first conquest of Franche Compté, were wrought at the Gobelines, from the designs of Le Brun. Louvois caused tapestries to be made, during his administration, after the most beautiful originals in the king's cabinet of Raphael, Julio Romano, and other famous painters in the schools of Italy, which were first drawn in larger dimensions by the most able French painters, such as La Fosse, the two Coypels, Jouvenet, Person, &c. The Gobelines manufacture, at one period, experienced a decline. Great abuses had crept into it; to remedy which, and revive the establishment, many committees were held at the house of M. Fagon, the financier, in 1737. At this time also considerable improvements were made in the mode of using the paintings, after which the tapestry was to be manufactured. There has always been an academy within the manufactory, in which the youths designed for artists are instructed in the various branches of the art, at the expence of the nation, and are also taught the other trades attached to the Gobelines. The wool and silk used in the tapestries are dyed in a part of the manufactory appropriated to that purpose, as it would be otherwise very difficult to procure the infinite variety of tints and shades, which are required. The materials are ready spun wools from the south of France, and the silks of Lyons.

Glass manufacture at St Gobins.

4. Louis XIV. seems to have been particularly anxious respecting the complete establishment and the perfection of those glass manufactures, which had been introduced by Henry II. and Henry IV.; but his efforts at first were unavailing. Artists were brought from Venice, and the king, for their encouragement, granted the directors and proprietors many privileges and immunities, and supplies of money. He was not, however, disheartened by his failure at first, but by perseverance at length succeeded to such a degree, that the glass manufactured at St Gobins was superior to that of Venice, both in quality and quantity. In order to facilitate and secure a good market for this manufacture, Louis, by an edict, laid a duty upon foreign glass imported into France to such an amount, as nearly to prohibit it; and a few years afterwards, finding that the home manufacture had still need of further protection and encouragement, he absolutely prohibited the importation of foreign glass. One circumstance in particular seems to have retarded the establishment and progress of this manufacture at first. We have already mentioned, that in the reign of Henry II. and Henry IV. it was established in the immediate vicinity of the metropolis; the consequence was that a scarcity of wood was felt; and it was removed into the neighbourhood of a large forest, with the advantage of a river, to ease the expence of carriage. This forest was that of St Gobins, whence the manufacture took its name. The whole is situated at the top of a small hill, close to the village of St Gobin, near La Fere and Chaumy, two towns in Picardy. The very white sand used in the manufacture is brought from the neighbourhood of Creil, a place 11 leagues distant from Paris: the glasses are sent by water to the capital, where they are polished and silvered.

Louis XIV. encouraged other manufactures besides those which we have just mentioned. By an edict of the 19th of October 1688, he granted to Noel de Varennes different immunities, to encourage him to carry on the manufacture of Drap de Londres, or cloth made in imitation of what was sent from London to Turkey, in the province of Languedoc. Afterwards that province was obliged to furnish Magi and his partners with 30,600 livres to carry on the same manufacture at Clermont and Sette. It also appears by another edict that this Monarch yearly appropriated a million of livres, exclusive of indulgences in the customs, to engage and reward skilful masters and artificers, who undertook to set up fabrics of cloth, silk, camel and goat's hair, crystals, and other commodities. In 1695, a patent was granted to Isaac Robelin, engineer, director of the fortifications of Burgundy, for the exclusive privilege of settling a tin manufacture in different parts of the kingdom. By an arret of 1703, it appears that the manufactures of bays, perpets, and serges, which had been set up, after the union between the crowns of France and Spain, had already attained such perfection as to rival those of England.

State at the close of the 17th centu- y.

Towards the close of the 17th century, the manufactures of France were not only very numerous, but many of them were carried on to very great extent, and supplied foreign nations. She supplied almost all Europe with all kinds of curious manufactures, toys, &c. England received from her a vast quantity of silk, linen, sail-cloth, canvas, beaver hats, glass, watches, clocks, paper of all kinds, iron ware principally the manufacture of Auvergne, shalloons, tammies, &c. from Picardy and Champagne, wines, and brandies; and Holland received most of these articles, besides saffron, soap, wood, honey, &c. The revocation of the edict of Nantes in 1684, gave a fatal blow to some of the most flourishing and lucrative manufactures of France, and may be said to have done them far more mischief than they had received benefit, by all the measures of Louis in their favour. The people whom he thus violently forced out of his kingdom, were generally, throughout all France, the best merchants, artificers, and manufacturers of that kingdom. Those who had most money retired into England and Holland; but the most industrious part of them settled in Brandenburg, where they introduced the manufactures of cloth, serges, stuffs, druggets, crapes, caps, stockings, hats, and also the dyeing of all sorts of colours. The goldsmiths, jewellers, watch-makers, and carvers, settled in Berlin. From this account, and from the additional fact that England is indebted to the refugees for her silk manufactures, and also for improvements in the manufacture of paper, hats, glass, watches, cutlery ware, jacks, locks, surgeon's instruments, hardware, &c. we may form a pretty clear, and accurate opinion, both of the state of manufactures in France, at the period of the revocation of the edict of Nantes, and of the irreparable mischief which Louis inflicted on those manufactures by that revocation.

Effect of e revoca- n of the lict of ntes.

The most important circumstance in the history of the manufactures of France, during the 18th century, previously to the commencement of the Revolution, respects the establishment of the cotton manufacture. The precise æra is not accurately known; but it was certainly carried on at Rouen in Normandy, a considerable time before the middle of the 18th century; and it is said to have been introduced by a Mr Holkar, probably an Englishman. Before the year 1747, the manufacture of cottons, or cotton-linens as they were then called, was established at Nantes in Brittany, where it was supposed it would succeed better than in Rouen, as cotton, wool, and indigo were cheaper. Such are the principal æras in the history of the manufactures of France; we shall now proceed to consider their state, before they were affected by the Revolution.

he on.

II. It may be proper to premise, that they are considered to have flourished most between the years 1650 and 1750; and that, subsequently to the last period, several causes, but chiefly the rivalship of English manufactures, acted unfavourably on them. The following are the principal manufactures which were carried on in France, before the Revolution, most of which still exist, though several of them are now very much depressed.

Woollen.

1. The *woollen manufacture.* Cloths of different qualities form the most important and extensive part of this manufacture; and the finest cloths are those for which France has always been chiefly celebrated. The very superfine French cloths are made at Louvieres in Normandy; those of Abbeville, in Picardy, though fine, are not to be compared with them in quality. The Londrines, made at Carcassone in Languedoc, which were formerly the most successful manufacture in France, so far as concerned the rivalry of England, and were manufactured expressly for the Turkish and Chinese markets, are also of fine quality. The cloths of Julienne, and the superfine fabrics of Sedan, as well in scarlet as in other bright colours, and in black, are fit only for the rich. Fine cloths are also manufactured at Rouen, Darental, Audelis, Montauban, and in various places in Languedoc and Champagne; but these are of various degrees of fineness, and applicable to various purposes. Those of Andelis in Normandy are fine mixed cloths, similar to such as are made at Abbeville. There are fabrics of a second sort of cloth at Elbeuf in Normandy, and at Sedan: those of Elbeuf are best suited for workmen and mechanics. Chateaurouge, before the Revolution, furnished a great deal of livery cloth. Romarantin, Issodoren, and Lodeve, furnish cloths for military clothing. There are still inferior coarser cloths, made for the wear of the paysans and country labourers. The fabrics at Rheims, before the Revolution, beside the sort called *draps de Rheims*, consisted of an imitation of Silesian drapery, called *Silesies*, imitations of our Wiltons, called *wiltons*, and casimeres, which they called maroes. Ratteens were made at Roybons, Crest, and Saillans; cloths and ratteens at Romans; cloths for billiard tables at St Jean-en Royans. Cloths of different descriptions and qualities were also made at Grenoble, Valence, Troyes, St Leo, Bayeux, Amboise, Niort, Coutange, Lusignon, &c. In the rank of coarse cloths, may also be placed the woollen stuffs of Aix, Apt, Tarascon, Oleron, Orthes, Bagneres, Pau, Auch, the valley of Aure; the cloths of Cevennes, Sommieres, Limoux, &c. The greater part of these cloths bear the names of the various places in which they are fabricated. Besides cloths, properly so called, camblets, callimancoes, baizes, kerseys, wool and hair plushes, are made at Amiens; druggets, flannels, blankets, at Rheims; blankets in the suburbs of Paris; flannels at Beauvais; serges at Aumale, Bicomt, &c.; camblets and plushes at Margny; hosiery at Compeigne and Rheims.

In endeavouring to ascertain the state of the woollen manufactures, previously to the Revolution, other particulars regarding it will be noticed, as well as other places pointed out, where the several branches were carried on with success. The above is only a general sketch of it.

In Picardy.

In the flourishing period of the manufactures of Picardy, it was calculated, that, in the city of Amiens only, they made 129,800 pieces of woollen stuff, besides 50,000 pieces brought from the adjacent parts, which for that reason were called *etoffes foreignes.* The value of the woollen manufacture at this place was computed to amount to nearly 1,600,000 livres annually. The extent and value of the manufactures of Abbeville were little inferior to those of Amiens. At Beauvais, 500 looms were employed in making the two sorts of cloth manufactured there, and 40 fulling-mills: 68,000 pieces of cloth were manufactured of 745,000 pounds

In Champagne. In Poitiers. In Anjou, &c. In Brittany. In Normandy. In Languedoc. In French Flanders.

of French wool, and 115,000 pounds of Spanish. The wool grown at this period in the province of Picardy, and used along with Spanish wool in their manufactures, amounted to 524 *milliers*. In that division of Champagne, which, previously to the Revolution, was called the department of Rheims, there were made, in the flourishing period of its manufactures, 84,000 pieces of stuff. In this department were included Rheims itself, Sedan, Vervins. In the generality of Poitiers, principally at Poitiers itself, and Niort, were annually made from 25,000 to 30,000 pieces of stuff; in the Orleannois, about 25,000 pieces of cloth. Romarantin, in this district, already noticed, made nearly 6000 pieces. In the provinces of Anjou, Tourraine, and Maine, about 18,000 pieces of stuff. In Berry, there were 34 places where cloth and other woollen stuffs were made; seven of which made from 3000 to 4000 pieces each; six from 2000 to 3000; and the rest about 800 or 900 pieces. The tapestry made in this generality amounted to 80,000 livres annually. In Brittany, 800 looms were employed, chiefly in making light stuffs. The principal places, Nantes, Rennes, St Brieux, &c. In Normandy, the woollen manufacture flourished extremely: in the generality of Rouen (that is, a division of the province over which an inspector of the woollen manufactures was placed), there were 12 looms, principally employed in manufacturing cloth, serges, and tapestry. The chief places for cloth were Darental, Elbeuf, and Louvieres. In the generality of Alençon, another division of Normandy, upwards of 60,000 pieces of cloth, and other drapery, were made: the principal places were Alençon and Aumale, in which latter place 1200 looms were employed in the manufacture of serge. Burgundy, Dauphiny, and Provence, were not very celebrated for their woollen manufactures. There was, however, a considerable manufacture of stockings at Dijon: about 1000 pieces of cloth made at St Jean-en-Royans, and about 6000 pieces at Romans. The manufactures of Languedoc were very important and flourishing. At Lodeve, 45,000 pieces, white and grey, were made; at Bezieres, Sept, and Carcassone, the manufactures were equally flourishing. In the middle of the last century, the annual product and manufacture of Languedoc, so far as it relates to our present topic, was as follows: sheep 1,000,000 livres; fustians and basins 90,000; blankets 230,000; bergames and tapestry 20,000; woollen stuffs, fine and coarse, 4,100,000; cloths, principally fine, 8,450,000; woollen stockings 40,000; hats 400,000; making a total of 14,330,000 livres. In French Flanders there were also pretty considerable manufactures of woollen goods, of various descriptions. At St Omer's, 350 looms were employed in making cloth, druggets, besides a great many stocking frames. At Lisle there were nearly 1000 looms employed in making camblets, besides several hundred in making callimancoes, &c.; and 200 frames in making stockings and caps. Above 300,000 pieces of stuff were made annually at this place. At St Pour, between Marseilles and Toulon, there is a manufacture of red worsted caps, which are very much worn by the peasantry of Provence, and the fishermen of Marseilles. Hence arose the *bonnet rouge* during the Revolution. It was introduced by the Marseillois as the fashion of their country. To this account a few miscellaneous articles may be added. Carpets were made at Rouen, at Arras, and at Felletin, a small town in the Lower Marche: these were called tapestry carpets; those made at Tournay were called carpets of *moucade*; tapestry at Arras, as well as the other places mentioned above; blankets in Normandy, Auvergne, and Languedoc; at Dartenat in Normandy, the best and finest; at Vernon, in the same province, of an inferior quality.

Such is a sketch, necessarily brief and imperfect, of the principal branches of the woollen manufactures of France at the period of their most flourishing state. Long before the Revolution, however, many of them had declined to a considerable degree. A few years previous to that event, the woollen manufacture at Carcassone was by far the most important. In 1786, the following is the state and balance of the trade in cloth for exportation to the Levant, manufactured at this place.

At Carcassone in 1786.

They manufactured every year at Carcassone 64,800 pieces of cloth, of which 800 only were sold in the kingdom for home consumption: the remainder exported to the Levant. The whole amount of cloth exported was worth 11,136,000 livres. The greatest part of the wool used in that manufactory was French wool, chiefly from Rousillon and Languedoc. They used a vast quantity of tin and cochineal in their dyeing. The cost of dyeing was estimated at 6 livres each piece of cloth. The price of the 300 bales of wool, each of 800 lbs. imported from Spain to mix with the native wool, came to 270,000 livres. The price of the drugs to 384,000; making a total sum, paid for raw materials from abroad, of 654,000 livres. They sold to the merchants of Marseilles, for exporting into Turkey, to the amount of 11,136,000: Leaving a balance for the workmanship, and the price of the raw materials of the growth of the kingdom, of 10,482,000 livres, or £458,587, 19s. sterling. In 1784, France exported cloth to the value of 15,530,900 livres; stuffs to the value of 7,600,000; and plush, &c. to the value of 4,425,100. The exportation of cloth, in the year 1787, had fallen to 14,242,400 livres; and that of stuffs, in the same year, to 5,615,800 livres. The produce of the whole woollen manufacture was rated, in 1789, at 140,000,000 of livres annually.

Silk manufacture.

2. The next manufacture in importance and extent is the *silk manufacture*; but of the state of this, when it was most flourishing, we cannot collect such details as we have given relative to the woollen manufacture; because, under the old government, the part of the kingdom, where there was any woollen manufacture, was cantoned into several departments, or districts, called generalities, with an inspector to each, and a superintendant over the whole; and thus a particular account of this manufacture might be obtained. We shall, therefore, be obliged to specify the principal places where the silk manufacture is carried on, and afterwards to give such estimates of its value before the Revolution as we can collect. The quality of French silk, and particularly that of Languedoc, is very good. It is made into woof, and even very beautiful organzine. Since the establishment of the silk mills at Vancauson, the French organzine has obtained a superiority over that of foreign countries. The woof made in Languedoc and at Alais is preferred. The annual export of raw silk from the latter, in the most flourishing state of its trade, was 1,200,000 lbs.

The most considerable manufactures of silk are those established at Tours, Lyons, Nismes, Avignon, Marseilles, and Paris. The silks of Tours and Lyons are esteemed of the best quality: Those manufactured at Nismes are far inferior. Florentine taffetas, English taffetas, and damask, are manufactured at Avignon. There are also silk manufactures at Rouen, Thoulouse, Auch, Narbonne, Amiens, and several other places.

The best gold and silver laces are made at Paris and Lyons; and some of inferior qualities at Montmorency, Sarcelles, Estrepagny, &c. Ribbons are chiefly made in Paris and Lyons: There are also large quantities manufactured at St Etienne and St Chaumont. Silk stockings, gloves, and mittens, are manufactured at Paris, Lyons, Nismes, Montpellier, Dourdans, &c.

During the most flourishing period of the silk manufacture of Lyons, it is computed that 18,000 looms were constantly and regularly at work, of which about 12,000 were employed in the manufacture of figured silks. The state of the manufacture in 1786 was as follows: The raw silks used were of different kinds, independent of the silks of the growth of the kingdom. They imported at Lyons, chiefly by the way of Geneva, raw silks from Piedmont to the amount of 668,850 livres; from Naples, to the amount of 263,400; and they employed native silks to the amount of 447,300: making the total value of the raw silks 1,399,550 livres. The fourth part of this amount was sent to different parts of the kingdom to be manufactured; the three other parts were employed at Lyons,—which gives an amount of 1,049,661 livres. Upon this computation it results, that they manufactured yearly in that city 349,887 pieces of stuff of all kinds. It was computed, that each piece brought a benefit to the manufacturer of 36 livres, or 12 livres for each pound of silk; which gives 12,595,932 livres. In the year 1787, the manufactures of Lyons employed 15,000 looms; in 1788, 14,777; and the number of workmen was 58,500.

In the most flourishing state of the silk manufacture, it was computed that nearly half the looms of the kingdom were employed at Lyons. There were besides at Nismes about 3000; at Tours from 1200 to 1500; and about 2000 at Paris. There were besides about 20,000 used for the making of silk stockings, and 10,000 for that of ribbons, galloon, and lace. In 1775, an inspector of the manufactures of Languedoc estimated the quantity of native silk in the whole kingdom at 30,000,000 of quintals, and the value of it at 79,000,000 livres Tournois. Some years afterwards, however, a much lower estimate and valuation was given, by which it appears that the native silk was worth 56,000,000 livres Tournois; 27,000,000 worth were imported. The whole value of the silk manufacture, including all descriptions, was 125,000,000; the raw material of which being of the value of 83,000,000, there remained for wages and profit 42,000,000. The amount of the various kinds of silk articles annually sent out of France were estimated as follows: Silken stuffs, taffetas, sattins, &c. 14,884,100 livres; ditto, mixed, 649,600; silken gauses, 5,452,000; handkerchiefs, 118,000; ribbons, 1,231,900; galloon 2,589,200; various other articles, 445,300; making a total of 25,370,100 livres.

n. 3. Linen is manufactured in most of the provinces, but principally in Brittany, Normandy, Picardy, Hainault, Cambresis, Flanders, Maine, Dauphiny, Auvergne, Beaujolais, Champagne, Gascony, and Anjou. Brittany and some parts of Normandy are most celebrated for this manufacture. The principal articles of linen cloth made in Normandy are those called low cloths, made in the vicinity of Fecampe, in the department of the Lower Seine; hemp-tow-cloths, made in the valley of Longueville, in the adjacent villages, and near Rouen; cloths used in the formation of oil-cloths and umbrellas are made at Ourville; a particular sort of linen, formerly sent to the Brazils, at St George's; *toiles a veste* in the vicinity of Bacqueville; strong flaxen cloths at Dieppe, Havre, Fecamp, &c.; tickings at St Loo, Evreux, and other parts in Lower Normandy; coverings for mattresses at St Vallery, St Laurent, &c.; linen cloth with blue and white grounds, for sailors' shirts, at St Laurent, Toqueville, &c.; damasked linen at Rouen, St Vallery, and Bolbec; in the article of printed linens only, the sale at Rouen, when the manufacture flourished, was computed at from £20,000 to £25,000 sterling per week. The quantity sold in the hall annually, averaged about 35,000,000 millions of livres. The principal linen manufactures of Brittany are sail-cloth and canvass at Rennes, Angers, Agen, (also at Marseilles and Mont de Marsan,) and what are called *Crez* and *Bretagnes*. In the middle of last century, 6000 bales of Crez and Bretagnes, were annually exported from Morlaix alone; 20 years afterwards the exportation fell to about 4500 bales; and at the commencement of the Revolution it fell below 4000. The annual value of these cloths made in Brittany, in the flourishing state of the manufacture, was about 1,200,000 livres. In several of the villages of this province, particularly at Vitry, the women and children used to be much employed in knitting thread stockings and gloves, which were sent to Spain, and even to the East Indies. They sold about 20,000 livres worth of them every year. Before the Revolution, France exported linen cloth to the amount of from 12,000,000 to 13,000,000 of livres; and lawn and cambric, manufactured principally in the French Netherlands, to the amount of 6,000,000.

Cotton. 4. Though the cotton manufacture is of comparatively late establishment, yet it had begun to flourish considerably before the Revolution. The principal seat of it was then, and indeed still is, Rouen and its vicinity, which has not inaptly been called the Manchester of France. Here cottons, made from materials called *tutacotin*, brought to France by way of Holland; cotton handkerchiefs; a sort of coarse cotton cloth, called *siamoise*; besides fabrics of mixed cotton and thread, were manufactured. There were also small manufactures of cotton goods in some other parts of France, at the period of the Revolution, particularly in Beaujolais, Languedoc, and Flanders; but we are not acquainted with any data on which to estimate the value of this manufacture. The quilts of Marseilles, which are still as much in use as ever in that part of France, where a blanket is a rare thing; the muslins of Rouen, Nismes, Bezieres, and Rheims; and the dimities and fustians of Alençon, Lyons, Troyes, and Toulouse, may be classed under this head.

Laces. 5. As the laces manufactured in France are made both of silk and thread, we shall consider them separately. Before the Revolution, they were a flourishing and important branch of trade. They are manufactured at Lisle, Valenciennes, Dieppe, Puy, Paris, Caen, Arras, Alençon, and Argentan, in the greatest quantity, and of the best quality. At Paris are made black and white laces of thread; and also at Valenciennes, Dieppe, and Puy. At Arras, *minionette* and *entoilage* laces, great quantities of which used to be brought to England. The point lace of Alençon has long enjoyed a great reputation through France, England, Germany, &c. The point lace of Argentan, called *point d'Argentan*, is also celebrated.

Paper. 6. In the beginning of the last century, there were seven provinces in France where the paper manufacture was chiefly carried on: Champagne, Normandy, Brittany, Angoumois, Perigord, Limosin, and Auvergne. At that period, England and other countries imported a great deal of paper from France; towards the middle of that century, however, the paper trade of France declined, in consequence of these countries making paper nearly sufficient for their own consumption. Previously to the Revolution, the chief paper manufactures of France were at Annonay, in the department of the Ardeche, very fine paper is manufactured here; at Montargis, in the department of the Loiret; at Essone, Courtalin; Rambervillier, in the department of the Vosges: Besançon, Ornant, Villafaut, Arbois, Arches, Archettes, and St Bresson. The total number of manufactories before the Revolution was about 200. Three classes of white paper for writing and printing are made; each class is divided into eight or ten different sorts: different coloured papers and pasteboards are also made; and paper hangings, executed with considerable taste, at Paris. Before the Revolution, the paper manufactured in France amounted to the annual value of 8,000,000 livres; 1,350,000 of which were exported to foreign countries, and 350,000 livres to the colonies.

Hides. 7. The best hides are those of the oxen of Auvergne, Limosin, and Poitou. Leather is prepared at Bayonne, Lectoure in the department of Gers, and St Germaine. The best tan-yards are at Paris, Dijon, Troyes, Coulommier, Rheims, Mezieres, Laon, Soissons, Rouen, Caen, Bayeux, Verneuil, Perche, Chartres, Orleans, Tours, and Beauvais: leather for harness is manufactured at Nemours, and Louviers. Goat skins are prepared at Paris, under the name of *maroquins*. Chamois leather is made, or imitated, at Niort, Strasburg, Grenoble, Annonay, &c. Buffalo hides are also manufactured in France; and parchment in Poitou, Languedoc, Flanders, Alsace, and at Paris. The parchment made in France is esteemed the best in Europe, and in time of peace is frequently imported into this country.

Hats. 8. Hats are chiefly manufactured at Lyons, Marseilles, Rouen, and Paris. Before the Revolution, considerable quantities were exported to the French colonies, and also to Spain and Spanish America, by the way of Cadiz; at that time, there were about 70 hat manufactories in the kingdom.

Nails. 9. Nails are made in almost every province in France; but the most considerable forges are in Normandy, Champagne, and Limosin: at Limoges, great quantities of nails, particularly for horse shoes, were made, and sent to Paris, previously to the Revolution. Pins and needles are made at Paris, Rouen, Bourdeaux, Limoges, Evreux, and Aigle. Cutlery at Montargis, Chatearault near Poitiers, where it is made with scarcely any division of labour, being in the hands of distinct and unconnected workmen, who go through every branch on their own account, and without assistance, except from their families; at Cosne, Moulins, &c. Steel is chiefly manufactured at Amboise, where it was established by the Duke de Choiseul; at St Etienne, Colmar, and Grenoble. Works in bronze and or-moulu are carried to great perfection in Paris. Clocks and watches are made in different parts of France, particularly at Paris, Cluse, and Carouges; the coarse movements are made at Dieppe and its vicinity. The number of watches sold annually in France, before the Revolution, was supposed to be 200,000. At Paris and Lyons, at the same period, 70,000 workmen were employed in the manufacture of jewellery: in the capital, every article of this kind, as well as all kinds of expensive and tasteful toys, are carried to great perfection. A few years before the Revolution, the art of casting cannon solid, and then boring them, was introduced by W. Wilkinson, who established a manufactory for that purpose, in an island in the Loire below Nantes.

Steel.

Jewellery.

China. 10. China is principally manufactured at Sevres, where it has long been carried to a high degree of perfection. Several manufactures of earthen ware, chiefly of the coarse kind, are carried on at Aubagne and other places; imitations of our Staffordshire ware are made at Chantilly and Paris; they are called *terre de pipe*; stone-ware is made at Moulins, and delft at Marseilles.

Glass. 11. The glass manufacture of St Gobins still retains its pre-eminence for large and beautiful mirrors; there are also glass manufactures at Moulins; at Baccarat in Lorraine, where three kinds were made, plate-glass, common glass for windows, and table-glass, the wood used in this manufacture amounted to between 8000 and 10,000 cords; it was brought down the Meurthe, and in other parts of the kingdom. A considerable trade in curious works of enamel was carried on at Nevers before the Revolution.

Other articles. 12. Under this head we shall notice all the principal remaining manufactures of France, which flourished previously to the Revolution. Soap of the first quality is made at Marseilles, where, and at Paris, great quantities of wash balls were also made: inferior soap was manufactured at Toulon, Bourdeaux, Rouen, Lisle, Abbeville, Amiens, and St Quintin. The amount of this manufacture was 60 millions, only two of which were exported. The principal manufacture of starch is at Paris. The manufacture of tobacco and snuff amounted to 22,000 cwt. of the former, and 2000 cwt. of the latter. Verdegris, chiefly at Montpellier; alum and Epsom salt in the neighbourhood of Mezieres; Glauber salts, which are esteemed of excellent quantity in the provinces bordering on the Mediterranean. The refining of sugar was principally carried on at Marseilles and Nantes. Cables and ropes at Brest, Rochefort, Toulon, Abbeville, Dunkirk, and Havre de Grace. Bleaching is carried on to a great extent in Picardy, principally in the vicinity of St Quintin. Dyeing of course is carried on at the seats of the principal silk, woollen, linen, and cotton manufactures. The waters of the Saone are excellent for scouring, containing, it is said, a soapy quality; those of the Rhone, from their purity, are equally adapted for dyeing; the waters of the little river Sornin are also reckoned remarkably good for dyeing; and it is generally supposed that the superior excellence of the French cloths, with respect to colour, especially with respect to black, results in a great measure from the purity of the waters which are used in dyeing.

Effects of the Revolution upon the manufactures of France. III. A revolution, such as that which for upwards of 25 years has afflicted and depressed the political and moral state of France, could not fail to press very severely on her manufactures. Most of them have suffered in a very great degree; others have passed through the trial not so much hurt; and some appear even to have been extended and improved during the Revolution. Of course, those suffered most which principally depended on foreign demand; for the commerce of France being in fact annihilated, the articles of home manufacture, which supplied that commerce, no longer being in equal demand, were no longer made in equal quantities. Another cause of the decline of the manufactures, especially during the last years of Bonaparte's reign, must be sought for in the conscription, which, in many instances, absolutely stript the manufactures of

Effects of the Revolution upon the manufactures of France.

nearly all their workmen. But though the general fact is sufficiently well established, that the manufactures of France are at present, almost universally, far inferior to what they were previously to the Revolution; yet the precise degree of deterioration cannot be ascertained, even with respect to the most important of them. We shall therefore be under the necessity of confining ourselves to a few brief and unconnected notices on this point.

The silk manufacture seems to have suffered the most. The number of looms employed at Lyons in 1788, has been already stated at 14,777. In 1801, according to Peuchet, author of the *Statistique de la France,* there were but 7600 looms, and many of them were unemployed. The exposé of the French government rates them at nearly the same number in 1814. The woollen manufactures of Carcassone were languishing previously to the Revolution; and that event has still further depressed them. Mr Birkbeck visited the fine cloth manufacture of Louviers, in 1814. He represents the establishment there for spinning woollen yarn as being on a large scale; and mentions that their cropping or shearing machines were performing their office with great precision. The manufacturers, according to him, are wide awake to mechanical improvements. Hence it would appear, that whatever injury this important manufacture may have suffered from the Revolution, with respect to the demand for its goods, it has been advancing in improvements during that time. The cotton manufacture undoubtedly has extended during the last 25 years; though, by the immense drain on the population which Bonaparte's wars with Russia, and from that period till the peace of Paris, occasioned, it has latterly been in a declining state. Probably the scarcity and the enormous price of the raw material also contributed to their depression. Mr Birkbeck visited a cotton mill at Deville, near Rouen, which employs 600 people; and he describes the machinery as good. Indeed, it is well known, that all the inventions and improvements in the cotton machinery with which we are acquainted, are used in the French manufactories at Rouen. Cotton manufactures have lately also been established at Chantilly, in French Flanders, &c.; and it is worthy of remark, that the same complaint is made with respect to the influence of this manufacture on the morals of the work people, as has long been made in this country. The linen manufacture of Brittany, and the manufacture of snuff and tobacco which is carried on there, especially at Morlaix, have suffered greatly during the Revolution. The Gobelin manufacture began to decline before that event; tapestry was not so much in fashion; and that branch of it which was confined to the dyeing of scarlet cloth, is now almost entirely at an end, in consequence of cloths of that colour being very little worn in France, and the Swiss regiments, the officers of which formerly consumed vast quantities of cloth dyed of the Gobeline scarlet, being no longer employed. We shall conclude this Chapter with a brief enumeration of those manufactures which at present are the most important in France. Mineral acids at Paris, Montpellier, and Rouen. Alum at Paris and Montpellier. *Baracans,* for lining pelisses, at Lisle, Amiens, and Valenciennes. Dimities, (*basins,*) at Troyes, Lyons, Toulouse, Chaillot, and Alençon. Lawn and cambrics at St Quintin, from which place formerly there were exported to Russia annually a million pieces, and Cambray. Prussian blue at Paris. Silk hosiery at Paris, Lyons, Nismes, Montpellier, Ganges, and Dourdan; worsted hosiery in the departments of the Aisne, and of the Somme, and particularly at Santerre. Cotton hosiery at Rouen, Troyes, Arcis-sur-Aube, and Sens. And in the departments of the North, and of the Maine and Loire, thread stockings are manufactured. Sweetmeats at Paris, Rouen, Tours, Orleans, Dijon, Sedan, Bourdeaux, &c. Cotton velvet at Amiens. Muslin, and other cotton goods, at Rouen. Cutlery at Paris, Moulins, Langres, Chatellerant, Thiers, Lisle, &c. Crapes at Lyons and Avignon. Gold and silver lace at Paris and Lyons. Silk lace at Fontenai, Purseaux, Louvre-en Parisis, Saint Denis, Montmorency, Gisors, &c. Lace made of flax, at Lisle, Valenciennes, Charleville, Sedan, Besançon, Dieppe, Havre, Caen, Puy, Arras, &c. At Dieppe, about 4000 women, chiefly wives and daughters of the seamen and fishermen, are employed in this manufacture; and at Puy about 6000. Cloth at Abbeville, Elbeuf, Louviers, and in Languedoc. Brandy at Bourdeaux, Rochelle, Cognac, the department of the Charente, Isle of Rhe, Orleans, Blois, Poitiers, Angers, Tours, Nantes, &c. Imitations of Hollands gin at Calais and Boulogne. Artificial flowers at Paris and Lyons. Gloves at Paris, Vendome, Grenoble, Avignon, Blois, Montpellier, Grasse, &c. Olive oil in the departments of the mouths of the Rhone, of the Gard, Var, &c. Serges at Aumale, Seignelay, Gournay, Auxerre, Sedan, Abbeville, Beauvais, &c. Liqueurs at Montpellier and Rouen. Writing and printing paper at Angouleme, Montargis, Annonay, &c. Stained paper at Paris and Lyons. Perfumeries at Montpellier, Grasse, Lyons, and Paris. Porcelain at Sevres and Paris. Ribbons adorned with gold and silver at Paris and Lyons. Other ribbons at Paris, Lyons, Tours, St Etienne, St Chaumont. Ferret-ribbons at Amiens and other places in Picardy. Ribbons made of flax at Ambert. Silks at Nismes, Lyons, Tours, &c. Silk and cotton stuffs at Rouen. Taffetas at Lyons, Nismes, Avignon, &c. Carpets at La Savonnerie, Aubusson, Beauvais, Rouen, Arras, Felleton, &c. Linen cloth at Rouen, and other parts of Normandy, Brittany, Courtray, Arras, Beauvais, Compeigne, St Quintin, Noyon, Peronne, &c. Velvets at Lyons. Verdegris at Montpellier. Vinegar at Orleans, Blois, Angers, Nantes and Paris. Glass at St Gobins.

CHAP. VI.

Commerce—Shipping—Coasting and Inland Trade—Fisheries—Total Produce of all kinds of Industry.

Commerce.

As the commerce of France has been nearly annihilated by the Revolution, we shall give a statement of it at the commencement of that event; and, in order that some estimate may be formed of its previous progress, we shall prefix a statement of it as it existed at the end of the reign of Louis XIV.

Between France and Spain.

I. The importations from Spain into France, at the end of the reign of Louis XIV. amounted to the value of 17,600,000 livres. Of this value, a great part consisted in specie. There were three methods principally, by which the French, at this period, obtained part of the specie or precious metals, which the Spaniards brought from their South American possessions. In the first place, French merchandise was carried to Cadiz, and exported thence in the galleons: in the second place, the productions and manufactures of France found a ready and extensive sale in Spain; and, lastly, the inhabitants of Auvergne, Limosin, and Gascony, annually went into Spain, where they assisted in the

Statistics.

harvests, or in other occupations, and returned, when they had obtained a competency, into their own country. At the period of the Revolution, the imports from Spain into France amounted to the sum of 33,300,000 livres in merchandize alone, without counting piastres, &c. to the amount of 62,500,000 livres. The imports from Spain, at this period, consisted principally of anchovies, olive oil, cocoa, almonds, lemons, oranges, raisins, brandies, luscious wines, chincona, saffron, jalap, liquorice, dyewoods, inlaid work, ashes, iron, copper, wool, silk, leather, hides, skins, indigo, cochineal, alum, vermilion, beasts of burden principally mules, silk handkerchiefs, toys, jewellery, household goods, and clothing for the marines. This value of 33,300,000 livres may generally be arranged into the following classes: 1. Raw materials, principally wool, ashes, and beasts of burden, to the value of 20,000,000; 2. Eatables, as well animal as vegetable, to the value of 7,000,000; 3. Wines and liquors, to the value of 4,000,000; and, 4. upwards of 2,000,000 in manufactured articles.

The exportations from France into Spain, at the end of the reign of Louis XIV. amounted to the sum of 20,000,000; at the period of the Revolution, they had increased to the sum of 44,400,000 livres. In this latter period, the exports chiefly consisted of the following articles: grain, vegetables, flour, cod, salted fish of other kinds, provisions of various descriptions, brandies, wines, sheep, mules, pigs; cinnamon, pepper, sugars of all sorts; pitch, tar, wool, cotton, silk stockings, hats, laces, woollen cloths, stuffs, handkerchiefs, gauzes, ribbons, linen, leather and skins, books, stationery, mercery, ironmongery, household goods, wooden works and metals. The manufactured articles amounted to the value of 26,500,000 livres; the raw materials, and beasts of burden, about 5,200,000 livres; the eatables about 11,000,000; and the wines and liquors about 1,500,000 livres.

Between France and Portugal.

II. The importations into France from Portugal, at the end of the reign of Louis XIV. amounted to the trifling sum of 340,000 livres, and consisted chiefly of hides in the hair, Brazil tobacco, olive oil, and dried fruits. At the period of the Revolution, the value of the imports had increased to the sum of 10,400,000 livres. They consisted chiefly of olive oil, cocoa, lemons, oranges, sweet wines, cinnamon, pepper, cloves, cotton wool, ivory, undressed goat skins, indigo, dyewoods, inlaid work of the East and West Indies, India cotton, and Brazil tobacco. The exportations from France into Portugal, at the end of the reign of Louis XIV. amounted to the sum of 740,000 livres, and consisted of woollen goods, linen goods, earthen ware, paper, &c. At the period of the Revolution, the exportations amounted to the sum of about 4,000,000, and consisted chiefly of grain, vegetables, hams, cotton, woollen stuffs and stockings, laces, ribbons, paper, skins, hides, mercery, glass, books, &c. The manufactured articles amounted to about 2,300,000 livres; the raw produce and provisions to about 1,600,000 livres.

Between France and Italy.

III. The importations into France from Italy, Piedmont, Savoy, and Switzerland, at the end of the reign of Louis XIV. amounted to the sum of 10,700,000: at the period of the Revolution, they had increased to 82,000,000, and consisted chiefly of corn, rice, vegetables, flour, olive oil, lemons, oranges, raisins, figs, cheese, lemon juice, liqueurs, manna, opium, senna, fresh fish, silk, goats and camels hair, hares wool, wood for fuel, ashes, sulphur, alum, galls, shumac, tartar, saffron, indigo, cochineal, lac, silken stuffs, gauzes, perfumery, essences, mercery, hardware, ribbons, white and coloured cottons, muslins, linen, and sackcloth. These importations may be divided into three classes: 1st, Manufactured articles to the amount of 16,800,000 livres; principally the silk ribbons of Padua, the crapes of Bologna, the stuffs and silk velvets of Genoa and Florence, and more especially the white and coloured cottons of Switzerland: 2d, Raw materials to the amount of 37,400,000, of which upwards of two thirds was of raw silk: 3d, Eatables to the amount of 28,300,000, of which 11,500,000 livres was for olive oil employed in the manufacture of fine soap at Marseilles and other places.

The exportations from France to these countries, at the end of the reign of Louis XIV. amounted to the sum of 28,400,000 livres. At the period of the Revolution, they had increased to 78,300,000; and consisted principally of rye, cod, oil, wines, brandies, oxen, sheep, pigs, goats, coffee, and other West India produce, copper, lead, cotton raw and spun, dye woods, inlaid wood, saltpetre, linseed, gum, red lead, copperas, stockings, hats, woollen cloth, laces, gauzes, handkerchiefs, ribbons, linen cloth, leather, skins, mercery, millinery, hardware, toys, jewellery, soap, glass. They may be divided into five classes: 1st, Manufactured articles to the amount of 30,800,000 livres; 2d, Raw materials, or such as had undergone only the first preparation, as cotton thread principally for Switzerland, to the value of 11,800,000 livres; 3d, Eatables to the value of 10,700,000 livres; 4th, Wines and liquors 5,000,000; and 5th, Colonial produce 20,000,000.

Between France and England.

IV. In 1686, the actual value of the importations from England into France, amounted to 18,000,000 of livres: viz. 8,400,000 of manufactures; 6,300,000 raw materials; and 3,200,000 in other articles. At the end of the reign of Louis XIV. the importations from England into France, amounted to the sum of 13,876,000 livres: viz. 6,000,000 in woollen and cotton goods, prepared skins, earthen ware, and other manufactures: 4,100,000 in metals, coal and horses; 3,700,000 in eatables, &c. At the period of the Revolution, they amounted to about 58,500,000 livres; and consisted principally of butter, salted meat and fish, colonial produce, corn, flour, rice, coal, copper, iron, lead, pewter, woollen goods, cotton goods, hardware, earthen ware, leather, ivory, whalebone, alum, copperas, white lead, horses, leaf tobacco, saddles, glass, &c. They may be arranged under three classes: 1st, Manufactured articles to the amount of 33,100,000 livres; 2d, Raw materials, particularly the metals, and coal, 16,400,000 livres; 3d, Eatables, &c.

In 1686, the exportations of France into England amounted to 23,300,000 livres: viz. 1st, Manufactures to the value of 11,700,000; 2d, Raw materials about 2,000,000; and 3d, Eatables, wines, liquors, &c. 9,600,000. At the end of the reign of Louis XIV. the exportations had greatly declined, not amounting to more than 18,000,000: viz. 12,000,000 of silk goods, cambrics, laces, &c.; 1,000,000 in raw materials, principally leather, cochineal, and indigo; and 5,800,000 in eatables, wines, liquors, &c. The exportations from France into Great Britain and Ireland at the period of the Revolution, amounted to about 38,000,000; consisting principally of plums, salt, wines, brandies, treacle, cotton, indigo, Spanish wool, laces, cambrics, lawns, glass, perfumery, gloves, millinery, vinegar, oils, cork, toys, jewellery, &c. They may be divided into four classes: 1st, Manufactured articles to the value of 7,300,000 livres; 2d, Raw materials 11,100,000 livres, of which two-thirds consisted of cotton from the French

West India islands; 3d, Wines, liquors, &c. 13,500,000; 4th, Eatables 5,500,000.

Between France and Holland.

V. The importations from Holland into France, at the end of the reign of Louis XIV. amounted to about 12 millions; viz. 2,500,000 manufactures, 4,700,000 raw materials, and 4,800,000 eatables, &c. At the period of the Revolution, they amounted to 33,100,000 livres; and consisted of corn, salted provisions, cod, salmon, cheese, butter, spices, Geneva, beer, wood, dye woods, ashes for manure, copper, ivory, steel, brass wire, lead, tallow, flax, linseed oil, skins, hogs bristles, madder, red and white lead, tobacco, linen cloth, paper, and hardware. They may be arranged as follows: 5,300,000 manufactured articles; 15,000,000 raw materials; 12,000,000 for provisions and liquors. The exportations of France into Holland, at the end of the reign of Louis XIV. amounted to 30,700,000: viz. 2,300,000 manufactures; 6,000,000 raw materials; 22,300,000 in wines, liquors, colonial produce, &c. At the period of the Revolution, the exportations to France amounted to about 46,000,000; consisting of colonial produce, corn, honey, rice, wines, brandies, plums, juniper berries, hops, tar, wool cards, Spanish wool, tobacco, galls, ochre, woad, turpentine, silk stuffs, gauzes, cambric, paper, soap, glass, leather, gloves, millinery, jewellery, &c. It may be divided into five classes: 1st, 6,700,000 manufactured articles; 2d, 7,100,000 raw materials; 3d, 3,200,000 wines, brandies, &c.; 4th, 23,000,000 colonial produce, particularly sugar and coffee; and 5th, 5,600,000 eatables, &c.

etween rance, and ermany, oland, russia, &c.

VI. At the end of the reign of Louis XIV. the importations from Germany, the Austrian Netherlands, Poland, and Prussia, into France, amounted to the sum of 9,000,000, principally in three classes: 1st, 3,700,000 manufactures; 3,000,000 raw materials; and 2,300,000 eatables, &c. At the period of the Revolution, the importation from these countries amounted to about 64,000,000: viz. about 31,000,000 for manufactured articles, principally the stuffs and laces of Flanders, and the tapes, linens, mercery, and hardware of Germany; 19,000,000 for raw materials, principally coal from Austrian Hainault, hemp and flax from Flanders, brass ware and potash from Germany, Poland, and Prussia; 13,700,000, principally for the horses and cattle of Germany and Flanders. The exportations from France to these countries at the end of the reign of Louis XIV. amounted to the sum of 14,100,000 in three classes: 1st, 5,100,000 of manufactures; 2d, 2,000,000 of raw materials; 37,000,000 of eatables, wines, liquors, &c. At the period of the Revolution, the exportations amounted to the sum of 95,600,000 livres, and may be divided into five classes: viz. 1st, 39,100,000 livres for manufactures of various sorts, especially silk stuffs, embroidered with gold and silver, for the different princes in Germany, and the rich nobility of Poland, lawn and woollen stuffs for the hereditary possessions of the house of Austria in Germany and Flanders; 2d, 12,900,000 livres in raw materials, principally wool and coal, a re-exportation for Austrian Flanders and Germany; 3d, Upwards of 10,000,000 in wines, brandies, and vinegar, for Germany, Poland, and the Prussian ports of the Baltic; 4th, 22,000,000 of colonial produce, particularly sugar and coffee, for the states of Austria and Germany, and the Prussian ports in the Baltic; 5th, 11,000,000 in vegetables and animals for Flanders and Germany.

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VII. At the end of the reign of Louis XIV. the importations into France from Hamburgh, Bremen, Lubec, Dantzic, Denmark, Sweden, and Russia, amounted only to 300,000 livres, and consisted principally of timber, hemp, iron, and other metals. At the period of the Revolution, these importations amounted to 31,600,000 livres, and may be divided into three classes: viz. 1st, About 5,000,000 of manufactured articles, principally those manufactured of flax and hemp, and India muslins, brought by the Danes from their possessions in the East Indies; 2d, 24,000,000 of raw materials, particularly copper and lead, through the Hanse towns, timber from Russia and Denmark, iron, pitch, and tar from Sweden, and hemp and tallow from Russia; 3d, 1,800,000 livres, principally for dried and salted fish from Denmark and Sweden. The exportations from France to these places at the end of the reign of Louis XIV. amounted to the sum of 6,800,000: viz. about 856,000 in woollen and linen goods; about 480,000 in copper, cork, &c.; and about 5,400,000 livres in eatables, wines, liquors, &c. At the period of the Revolution, the exportations from France to all these places, amounted nearly to the value of 80,000,000, and may be arranged in five classes: viz. 1st, 3,600,000 livres in merchandize and manufactures, chiefly for the Russian market and the Hanse Towns, and a small quantity for Sweden and Denmark; 2d, About 7,100,000 in raw materials, particularly indigo, and other drugs for dyeing, and cotton, for the Hanse towns, Sweden, and Denmark; 3d, About 12,000,000 in wines, brandies, &c.; about one-half of this went to the Hanse towns, about a fourth each to Denmark and Russia, and only about one-eighth to Sweden; 4th, About 2,000,000 in vegetables, minerals, and animals; and 5th, About 55,000,000 in sugar and coffee from the French West India islands; of which 47,000,000 was sent to the Hanseatic towns, three-fourths for Hamburgh, and the remainder in nearly equal proportions to Sweden, Denmark, and Russia.

Between France and America.

VIII. The commerce between the United States of America and France, owes its existence entirely to the rupture between them and Great Britain, which terminated in their independence. During the three first years after the treaty of amity and commerce between the United States and France, concluded in January 1778, the importation from them into France averaged annually the sum of 2,460,000 livres: viz. 136,000 in rice and dried cod; 357,000 in wood, indigo, skins, and other raw materials; and 1,900,000 in leaf tobacco. The exportations from France at this period, amounted to 3,200,000: viz. 191,000 in spiceries; 79,000 in wines and liquors; 33,000 in raw materials; and 2,900,000 in manufactured goods, particularly woollen cloths, linen, silk, cotton velvet, hosiery, hats, mercery, earthen ware, East India goods, copper utensils, and warlike stores. The importations from the United States to France, from 1781 to 1783 inclusive, averaged 3,494,000 livres: viz. 69,000 in rice and salted cod; 192,000 in raw materials; and 3,233,000 in leaf tobacco. The exportations from France at the same period, amounted to 11,500,000 livres, and may be arranged under four classes: 1st, About 825,000 livres in provisions and groceries; 2d, About 457,000 in wines, brandies, &c.; 3d, About 378,000 in raw materials; 4th, About 9,800,000 in manufactured articles, principally of the same description as those exported during the former period. Taking the average of the three years which preceded the French Revolution, the importations from the United States into France amounted annually to 9,600,000 livres, and may be arranged under four heads: viz. 1st, About 600,000 in rice, and other articles of food; 2d, About 900,000 in raw materials; 3d, About 700,000 in fish; and 4th, About

7,300,000 in leaf tobacco. The principal articles were, besides rice, tobacco, and fish, corn, maize, wood of every sort for ship-building, undressed skins, pitch, tar, potash, flax seed, &c. The exportations from France to the United States at this period, only reached about 1,800,000 livres, of which 1,200,000 were in wines, brandies, &c. and the remainder in manufactures.

Between France, and the Levant and Barbary.

IX. At the end of the reign of Louis XIV. the importations from the Levant and the coast of Barbary to France, amounted to 3,400,000. At the period of the Revolution, the importations amounted to 37,700,000 in three classes: 1st, About 1,500,000 in the stuffs of the Levant; 2d, About 29,000,000 of raw materials, principally cotton, silk, wool, goat's skins, leather, &c. 3d, About 7,600,000 in wheat, barley, pulse, olive oil, and Turkey coffee. The exportations from France for the Levant and the States of Barbary, at the end of the reign of Louis XIV. were only 2,000,000. At the period of the Revolution, they had risen to the sum of 25,600,000 livres. They may be arranged under four heads: 1st, About 8,100,000 in West India coffee, sugar, and liqueurs: 2d, About 3,200,000 in indigo, and other dyeing stuffs; 3d, About 9,300.000 in woollen cloths, hosiery, silk goods, and handkerchiefs; 4th, About 5,000,000 in specie, as sequins, piastres, &c. Nearly the whole of the commerce between France and the Levant and Barbary States, was carried on at Marseilles. From this port, were sent to the ports of the Levant the cloths of Languedoc, chiefly those manufactured at Carcassone, Clermont, and Lodeve, dyewoods of various descriptions, sugars, coffee, indigo, cochineal, cinnamon, pepper and other spices, lead, iron, pewter, tin, paper, liqueurs, syrups, fruits, millinery, silken stuffs, lace, linen cloth, toys, &c.; and in return, France received by Marseilles, raw and spun cotton, wool, gum, wax, silk, galls, madder, opium, goat's and camel's hair, raw and dressed hides, tallow, carpets, coffee, incense, myrrh, rice, sal-ammoniac, tamarinds, senna, ostrich feathers, grain, oil, &c. Before the Revolution, the trade to the Levant employed 400 vessels of the burden of about 47,000 tons, and the value of their cargoes nearly 41,000,000 francs.

Summary of the commerce between France and all the countries of Europe.

The importations of all the countries of Europe into France, at the end of the reign of Louis XIV. amounted to the sum of 71,000,000; and at the period of the Revolution to 380,000,000, being an augmentation in the proportion of nearly 5½. The exportations from France to all the rest of Furope, at the end of the reign of Louis XIV. amounted to the sum of 105,000,000; at the period of the Revolution to 424,000,000, being an increase in the proportion of 4 to 1. The exportations at both periods may be arranged under five classes. The first comprehends the productions of the soil of France. At the end of the reign of Louis XIV. these amounted to 36,000,000; at the Revolution to 93,000,000. The second class comprises the articles of French industry, amounting at the first period to 45,000,000; and at the Revolution to 133,000,000. The third class comprises the produce of the French West India islands re-exported from France, amounting at the first period to 15,000,000; and at the Revolution to 152,000.000. The fourth class comprises the re-exportations of the produce brought by the French from the East Indies, amounting on the first period to 2,650,000 livres; and at the Revolution to 4,160,000. The last class comprehends foreign merchandise and manufactures re-exported from France, amounting at the end of the reign of Louis XIV. to 6,000,000; and at the Revolution to 40,000,000.

Between France, and India and China.

X. The commerce between France and India and China was established in 1694. At the end of the reign of Louis XIV., the French possessions in the East were few, and of little moment; consisting only of some country houses at Pondicherry, Surat, and Masulipatam; an establishment at Canton, another at Mocha, and a third at Bander Abassi, in Persia; but there was so little trade, that, between 1699 and 1719, not more than one or two vessels were annually employed in it; their cargoes, however, must have been valuable, since, at the end of the reign of Louis XIV., the importations from the East Indies amounted to 6,368,000 livres, consisting principally, 1st, of pepper and coffee, to the value of 2,757,000; 2d, of muslin, 2,790,000; and lastly of gold in ingots, 400,000 livres. The exportations from France to Asia, at the same period, amounted to 2,852,000 livres, of which there were 2,173,000 in piastres, 542,000 of wrought coral, and 107,000 in metals, &c. At the period of the Revolution, the cargoes brought from Asia into France were valued at 34,700,000 livres, on the average of 1785, 1786, and 1787, consisting, 1st, of manufactured commodities, such as plain and printed cottons, muslins, handkerchiefs, nankeens, and silken stuffs, to the value of about 26,600,000 livres: 2d, of cinnamon, pepper, tea, and Mocha coffee, to the value of 6,000,000: 3d, of wood, raw silk, cotton, ivory, &c. to the value of 1,150,000 livres: 4th, of porcelain, fans, and shells, to the value of 493,000 livres; and, 5th, of drugs and dyewoods, to the value of 367,000 livres. The exportations from France to Asia, at the same period, amounted to 17,400,000; and consisted, 1st, of 15,253,000 livres, in piastres: 2d, of manufactured articles, to the value of 654,000 livres: 3d, of wines and liquors, to the value of 745,000 livres: 4th, of wood and metals, to the value of 700,000; and, lastly, of various other articles, to the value of 72,000 livres.

Between France and west of Africa.

XI. At the end of the reign of Louis XIV., the importations into France, from the western coasts of Africa, amounted to about 500,000 livres, chiefly in gums, elephants' teeth, hides, &c.; the number of slaves annually bought was about 2000. The merchandise exported from France, at this period, to this part of Africa, amounted in value to about 650,000 livres. At the period of the Revolution, the exportations for the western coasts of Africa, amounted to 18,000,000, of which nearly 10,000,000 consisted of foreign commodities re-exported; and about 8,000,000 of the produce or manufactures of France. The importations, on an average of 1785, 1786, and 1787, from this part of Africa, amounted to about 1,400,000 livres, in gums, elephants' teeth, and hides principally. At this period about 30,000 slaves were annually bought. No trade was carried on to the isles of France and Bourbon, previously to the year 1735, when La Bourdonnaie was sent out as governor. At the period of the Revolution, the exportations from France to these islands amounted to 4,600,000 livres, chiefly in metals, wood, wines, brandy; and some manufactured goods, cloths, and gilt toys. The returns amounted to 2,700,000, principally in Bourbon coffee.

Between France & the West Indies & N. Am

XII. The importations into France, from their West India and North American possessions, in the reign of Louis XIV. amounted to 16,700,000 livres, viz. 11,000,000 in sugar and chocolate; 4,081,000 in indigo; 775,000, in cotton, hides, skins, &c.; and 900,000 in tobacco. The exportations from France, at the same period, amounted to about 9,000,000; viz. 4,160,000 in manufactures; 1,900,000 in provisions; 1,564,000 in wines, brandy, &c.; and about the same amount in timber for building, metals, &c. At the period of the Revolution, France received from her West India and American possessions, about 185 millions; viz. 1st, about 134,900,000 in sugar and coffee alone: 2d, about 26,000,000 in cotton: 3d, about 11,600,000 in indigo, and other drugs for dyeing: 4th, about 10,000,000 in cocoa, chocolate, ginger, &c. The exportations from France, at this period, were about 77,900,000 livres, which may be arranged in five classes; 1st, 42,447,000 in manufactured goods: 2d, about 19,611,000 in flour, pulse, salted provisions, cheese, &c.: 3d, about 7,285,000 in wines and brandy: 4th, about 6,513,000 in wood, metals, &c.; and, lastly, about 2,057,000 in articles of less importance.

General summary.

It must be obvious, that perfect accuracy respecting the value of the particular or total exportations and importations cannot be obtained; we need not, therefore, be surprised to find them estimated differently by different authors. According to some, the exportation in 1787 amounted in all to 542,604,000 livres; of which, 311,472,000 were the raw produce of the soil, mines, and fisheries; and 231,132,000 the produce of French manufactures. Arnould, author of the treatise *De la Balance du Commerce de la France*, is of opinion, that, about the same period, the value of the exports of the produce and manufactures of France was 364,000,000, which he supposes to be thus divided among the different parts of the kingdom. The maritime districts partook to the amount of 228,000,000; the frontier districts to the amount of 77,000,000; the interior districts only to the amount of 11,000,000; the cidevant generality of Paris, to the amount of 18,000,000; and the district round Lyons, comprehending the department of the Rhone and the Loire, to the amount of 29,000,000.

The imports of France, upon an average of the years 1785, 1786, 1787, are calculated at 611,008,200 livres. In 1792, the average imports amounted to no more than 319,000,000, according to the report of Roland to the Convention. By an official report laid before the Consuls, 22d September 1800, it appears, that the value of the imports was 325,116,400 livres: of which, 114,190,100 was in provisions, liquors, &c.; 133,591,500 in raw materials; upwards of 35,000,000 of this being cotton wool, and 39,265,500 was in foreign manufactures. The exports that year amounted to 271,575,600; of which, 87,562,500 consisted of provisions, wines, liquors, &c; 33,698,000 of raw materials; and 140,854,200 of manufactured goods; of these last, the silk amounted to 41,222,000, the linen and hempen cloth to 34,866,000, the woollen drapery to 23,146,000, and the cotton stuffs to 12,335,000. In the same year, the imports from Spain were valued at 64,446,500; the exports to Spain at 62,441,400: The imports from the Batavian republic at 80,788,300; the exports at 37,751,600: The imports from the Ligurian republic were 26,561,600; the exports 23,010,700: The imports from the Helvetian republic 17,008,600; the exports 38,809,100. Making the total imports from friendly and allied powers 188,805,000; and the total exports to them 162,012,800. The total imports from neutral powers were 84,783,300; of which, upwards of 82,000,000 were from Denmark, Sweden, Prussia, and the Hanse towns; and only about 2,000,000 from the United States. The exports to the same powers were 33,527,400; of which, only 557,700 were to the United States.

Amount of the tonnage of the French shipping.

There are no data on which an estimate of the number or tonnage of the French shipping, at the end of the reign of Louis XIV. can be formed; but in 1669, Colbert reckoned that France employed only 600 in foreign commerce; and it is supposed, that at the beginning of the 18th century this number had not increased to much above 800 vessels, of from 100 to 250 tons burden. If this latter supposition be correct, they must have declined in the middle of this century; for the anonymous author of a pamphlet, entitled the *Present State of the Revenue and Forces of France and Spain, compared with those of Great Britain*, 1740, asserts, that in France there were not then more than 600 sail of merchant ships at the most, of all sizes; and that, reckoning 25 sailors to each, one with another, all the seamen of France did not exceed 30,000, including 11,000 seamen classed by the king, who had leave to serve aboard the merchant ships, till they were wanted for the king's service. At the period of the Revolution, the number of ships employed in long voyages, either to the East and West Indies, or to the whale and cod fisheries, amounted to 1000, averaging 250 tons each. The exports to different countries in Europe employed, at this period, about 580,000 tons; of which, little more than one-fourth, or 152,000 tons, were French. In 1792, an official report was made by Roland to the National Convention; from which it appears, that in that year there entered inwards into the ports of France, 7607 vessels, amounting to 639,225 tons; of which, 1823 vessels, or 147,821 tons, were French; 1940 vessels, or 145,012 tons, were English; and 3344 vessels, or 346,402 tons, belonged to other nations: and in the same year there cleared outwards 8618 vessels, amounting to 544,935 tons; of which, 1940 vessels, or 147,410 tons, were French; 3111 vessels, or 90,662 tons, were English; and 3567 vessels, or 306,863 tons, belonged to other nations. From an official report laid before the Consuls in 1800, it appears, that at that time the total number of ships employed in foreign commerce, that entered inwards, amounted to 7581, or 273,137 tons; of which, 2975 vessels, or 98,304 tons, were French; the rest belonged to foreigners: That the number of vessels cleared outwards, amounted to 8636, or 312,967 tons; of which, 3358 vessels, or 104,687 tons belonged to France. That the coasting trade between the ports of France employed about 26,000 vessels, (including repeated voyages,) or about 700,000 tons, nearly the whole of which were French. The colonial and fishing vessels entered inwards were 71, or 4769 tons; and cleared outwards, 296 vessels, or 10,000 tons.

Coasting and inland trade.

The coasting and inland trade of France, before the Revolution, were both very considerable; indeed, it has been calculated, that the bringing the products of the south parts of France along the coast, to those of the north, for the supply of the capital and the northern provinces, constituted a coasting trade only inferior in magnitude to the coal trade of England. The ships loaded at Bourdeaux, with wines and fruits of all sorts, used to set out in a fleet, and under convoy in time of war, and stop near the Isle of Rhe, where they were joined by the ships from Rochelle, laden with wine, fruits, and corn; hence they proceeded to the coast of Brittany, where they were joined by another fleet from Nantes and St Maloes, laden with brandy, corn, &c. The fleet thus collected used frequently to amount to 150 or 200 sail. The very supplying of the city of Paris with wood for fuel, employs an immense number of boats, carts, &c. A large portion of the inland trade of France is still carried on by means of the numerous

Fairs. fairs, which are kept in various parts of the kingdom: a proof, if proof were wanting, that this country is far behind Great Britain in commercial industry, habits, and capital. We cannot pretend even to enumerate all the principal fairs in France; but the fair of Beaucaire must not be passed over entirely without notice. It was formerly kept within the city of Beaucaire, in Languedoc; but, when the reputation of it increased, it was found necessary to keep it principally in the open country; and though the Revolution has affected it, yet it is still much frequented. It begins on the 22d of July, and continues three days. The conveniency of the Rhone, on which Beaucaire stands, draws to its fair the merchandise of Burgundy, Lyonnois, Switzerland, and Germany. The Lea, from which it is but seven leagues distant, brings the merchandise of the Levant, Italy, and Spain; and by the canal of Languedoc, it receives all that comes from Upper Languedoc, Brittany, and the ocean. Besides traders from most parts of continental Europe, before the Revolution, there used also to be there Armenians, Persians, &c. The chief articles sold here are spices, drugs, hard ware, woollen and silk stuffs, Spanish and Barbary wool, French wool, &c.

Fisheries. The French fisheries, as they existed previously to the Revolution, naturally divide themselves into two branches. The first branch comprehends the distant cod fishery on the banks of Newfoundland, Iceland, &c. and the whale fishery in the Greenland seas and the Southern Ocean; the second branch comprehends the near fisheries, on the coasts of France, in the Mediterranean, and in the ocean. These consist of the fisheries of the herring, the mackerel, the sardine, the anchovy, the tunny, &c.

Cod fishery. The French government does not appear to have paid any attention to the cod fishery on the banks of Newfoundland till the year 1660; and then a monopoly of it was granted. A few years after the peace of Utrecht, that is to say, about the end of the reign of Louis XIV. the whole produce of the cod fishery did not amount to more in value than a million of livres. When France lost Newfoundland, she established these fisheries at Cape Breton; and, in 1745, more than 100 vessels arrived there from the mother country to engage in them. There were, besides, at this period, from the Gut of Causo, down along the shore to Louisburg, and thence to the N. E. part of Cape Breton, annually employed at least 500 shallops, containing in all 2500 men; and 60 brigs, &c. containing 900 men; in all, 3400 men. The total number of fish annually caught and salted at Cape Breton was estimated at 186,000 quintals. There were also cod fisheries at other harbours on these coasts; so that, on the most moderate estimate, it was reckoned that there were 1,149,000 quintals of salted cod brought to France from all her North American fisheries; the value of which, and of the oil made, was estimated at upwards of £800,000 sterling. The war of 1756 was ruinous to this fishery; nor did the treaty of peace in 1783 quite re-establish it. In 1786 there were cured 426,400 quintals of fish, and upwards of 1000 tons of oil were made. In the following year, the quantity of both had greatly diminished, there having been only 128,590 quintals of fish, and 323 tons of oil. In 1788 and 1789, the quantity of both increased; but, during the first years of the Revolution, both had fallen almost completely away. At the period of the Revolution, the produce of the French cod fishery was valued at 15,731,000 livres. In this sum is included the value of the sedentary fishery, as it is termed, of the inhabitants of the isles of St Pierre and Maquelin, which is rated at 1,800,000 livres; that of the inhabitants of Dunkirk, near Iceland, which is rated at 1,200,000 livres.

Whale fishery. With respect to the whale fishery, it was carried on, in the beginning of the 16th century, by the inhabitants of Biscay, to a considerable extent, and with great skill, enterprize, and success; and, towards the middle of the 17th century, was very productive. The inhabitants of St Jean de Luz, Bayonne, and Ciboure, sent there between 50 and 60 ships, the Dutch not having yet embarked in it. In 1690, it wore a different aspect: the Basques scarcely sent out 20 vessels, while the Dutch sent out more than 300. At the end of the reign of Louis XIV. the Basques sent out from 12 to 15 vessels annually to this fishery. Since that period, this branch of fishery has been almost totally lost to the French; towards the middle of the last century, indeed, the government made some efforts to re-establish it at Bayonne and St Jean de Luz; but their efforts were unavailing. After the peace of 1783, the minister of the marine brought over to Dunkirk some Nantucket whalers, to assist and instruct the inhabitants in that fishery. At the commencement of the Revolution, there sailed from that port 15 vessels to Greenland and the South Seas; which is about the number that annually sailed towards the end of the reign of Louis XIV. The produce was valued at 700,000 livres. In 1794, 40 vessels were employed at Dunkirk in this fishery, but soon afterwards it was totally ruined by the war.

Herring and other fisheries. The herring fishery was pursued by the French in the 11th century, chiefly on the coasts of the Channel. At the end of the reign of Louis XIV. the produce of this fishery appears to have been about 1,200,000 livres; and at the commencement of the Revolution, 4,300,000 livres. The fishery of mackerel and sardines were established by the superintendant Fouquet, towards the end of the 17th century, principally at Belleisle, on the coast of Brittany. Like the herring, the sardine is a fish of passage, appearing upon the French coasts at certain seasons in shoals; but it is never found in any of the rivers. They are met with both in the ocean and the Mediterranean, especially in the latter. The small sardines caught on the coast of Provence, are esteemed by epicures as being superior to all others of this species. From 1000 to 1200 fishing smacks and boats are engaged in catching these fish on the coasts of Brittany, Provence, &c. from the month of June to the middle of October. The French frequently cure their sardines in red wine, and when thus prepared, call them by the name of *anchoisies*, or anchovied sardines. Fresh sardines are conveyed on horseback from the ports of France to the inland cities and towns of that country. Anchovies are fished for on the coast of Provence in the months of May, June, and July, at which season shoals of this fish come regularly into the Mediterranean. They are sent to Paris from Cannes, Antibes, St Tropez, and other places in Provence. Vast quantities of them are also exported to foreign countries. Pilchards are taken on the coasts of Brittany, and employ annually about 300 small vessels. The tunny fishery of the Mediterranean is a singular and important branch of industry: the manner in which this fish is caught, has been called a sort of hunting at sea; the best and most certain methods are the *thonnaire* and the *madrague*. The former in many places is only an inclosure formed by nets for catching the tunny: but at St Tropez, and on the coast of Provence, the *thonnaire* is a net placed in a spiral form, in which the tunnies, when caught, are almost always dead, because it closes their gills, and chokes them, for which reason the *madrague* is preferred. This is, in fact, a vast inclosure, composed of three large nets, divided by others into many chambers or compartments: before the net, towards the open sea, is a large passage, formed by two parallel nets: the tunnies, running in between them, enter the *madrague*, and passing from chamber to chamber, they arrive at last at what is called the chamber of death, or the *corpou*, or *corpus*. After every thing has been made ready, the fishermen draw up the nets of each chamber, in order to force the fish to enter that, which must prove fatal to them. The fishermen are in the habit of throwing some drops of oil into the sea, and entirely covering their heads with cloths, to enable them to perceive whether any fish are in the inclosure. They also fasten at the bottom of their boat an ass's head, to entice the tunnies, which generally go to the edge of the *corpou* to see this head. The tunnies have great force in their tails, so that much caution is required in getting them into their boats. They come in such shoals, that in the height of the season, that is, in the months of May and June, from 500 to 600 are sometimes taken in a day, at one *madrague* only. They commonly weigh from 10 to 20 or 25 lb. each; but they have been known to weigh 50 lb. The tunny is eaten fresh in all places to which it can be conveyed sweet. The flesh, for so it may be called, is not less solid than that of the sturgeon. Pies are made of it, which are so celebrated, as to be sent all over France. When it is pickled, it is cut into slices, which are dipped in oil, after they are impregnated with the salt. The oil which comes from these fish when they are washed, and which is pressed out when they are seasoned, is used by tanners. The tunny fishery has been less productive since the war, for they are easily frightened; and the firing of the batteries on the coast appears to have kept them at a great distance. There are four *madragues* at Marseilles, which are rented out to the fishers by the town, at a considerable advantage. There are also two at St Tropez, which are rented by the government at 10,600 francs. Two nets are necessary to each, and each net costs about 3000 francs. For the net of the *corpou*, 250 lbs. of cork are required. This net sometimes remains for a year or two in the sea; but those which form the internal chambers and the entrance passage, are changed every six months. The sea, in the spot in which the *madrague* is placed, is generally 40 fathoms deep. When Louis XIII. visited Marseilles in 1662, he was invited to a tunny fishery, at the principal *madrague* of Margion, and found the diversion so much to his taste, that he often said it was the pleasantest day he had spent in his whole progress through the south of France. Vernet, among his other sea-pieces, has a very good one of this fishery. The other fish caught on the Mediterranean coast of France, are the palamede, which, though much smaller than the tunny, is probably of the same species; it is mentioned by Gibbon, in his description of Constantinople, as, at the time of the foundation of that city, the most celebrated among the variety of excellent fish taken in the Propontes; the *d'orade*, the *pageau*, the *loup*, &c.

Red coral is found in the Mediterranean, on the shores of Provence, from Cape de la Couronne to Cape St Tropez. They use two machines in fishing for it. The one, which pulls it from the rocks, is a large wooden cross, in the centre of which is a heavy leaden ball; at each extremity is fixed a round net. The divers push one or two arms of the cross into the cavities of such rocks as contain coral, and the boatmen draw it up. The other machine is used for drawing coral out of the deepest waters. It is a long beam, at the end of which is fixed an iron ring, having a reticular bag, with two round nets at each side. The ring breaks off the small branches, and the nets entangle and retain the others. A company has long been established at Marseilles for this fishery. There are seven or eight men to a boat, one of whom is the patron or proprietor. When the fishery is ended, which produces on an average 25 quintals of coral to each boat, it is divided into 13 parts, of which the proprietor has four, the caster two, and the other six men one each; the remaining one belongs to the company. Coral is part of the traffic of Marseilles. Bracelets and necklaces are made of it there and at Genis, and sell very well up the Levant.

Oysters.

Oysters are found in various places on the coast of France. At the mouth of the Seine, they are few in number, but of excellent quality. On the coast of Caen in Normandy, there is a bank six miles in length and one in breadth. They are also found in the bay of Isigny, and in the neighbourhood of Cherbourg. Those in particular are highly valued which are collected at the mouths of some streams, where the sea water is sometimes thrown entirely back, and which are called *huitres de pied*. Granville in Normandy gains 50,000 livres by this fishery. On the coast of Brittany there are very large oysters, particularly at Curcale, where a great many are preserved in places inclosed for that purpose. The oysters of Roscoff are also particularly celebrated; they are brought in great abundance to Morlaix, and are by some preferred to those of Curcale. The bank at Painpol is almost entirely exhausted. At the mouth of the Loire, between the rocks on the coast of Poitou, on the coast of Aunis and Saintonge, where those who make bay-salt transplant oysters to marshy places, also *à la tete de Buch*, near Bourdeaux, oysters are found. In Languedoc, near Cape Leucate, there is an oyster bed at the depth of 20 feet. There is also one at the mouth of the Rhone. At Paris, those oysters are most esteemed which come from Brittany, Rochelle, Bourdeaux, and particularly from Medoc, so celebrated for its claret. The principal fish which the rivers of France yield, are salmon, carp, trout, pike, and eels.

The importance and value of all these branches of home fishery are very considerable: At the end of the reign of Louis XIV. their value was at least 1,700,000 livres; at the commencement of the Revolution, it had increased to 9,800,000 livres.

Having thus given a detailed account of French industry, as exercised in agriculture, manufactures, commerce, &c. we shall conclude with laying before our readers an estimate of the value of the annual reproductions in these branches, or their gross produce at the close of the 17th century, and at the commencement of the Revolution; premising, however, that such an estimate must necessarily be only an approximation to the truth, and that it is interesting and important, not so much from its general result, as from the comparison which it presents between the value of different branches of industry.

General produce.

In 1698, D'Avenant reckoned the general produce of the land, and of the interior and external commerce of France,—in short, the produce of all the occupations of her citizens,—at £81,000,000 sterling, or

Statistics. General produce.

1,984,500,000 livres tournois, or 36,750,000 marcs, at 54 livres to the marc.

The economistes, some years previous to the Revolution, valued the annual reproduction at between 3,134,000,000 and 4,000,000,000 livres.

In 1789 there appeared in France a memoir on the commerce of that kingdom and her colonies, which supplies the following details on this subject.

1. *Agriculture.*

	Livres.
Corn,	700,000,000
Cattle,	460,000,000
Hay and forage,	60,000,000
Wine, brandy, &c.	350,000,000
Oil,	60,000,000
Wood,	146,000,000
Wool,	35,000,000
Silk,	25,000,000
Hemp and flax,	50,000,000
Total of agriculture,	1,826,000,000

2. *Manufactures.*

Linen,	161,250,000
Woollen,	92,500,000
Silk,	41,600,000
Millinery,	5,000,000
Tapestry, carpets, &c.	800,000
Mercery and hardware,	75,000,000
Leather,	6,000,000
Paper,	7,200,000
Jewellery, &c.	2,500,000
Glass, iron, earthenware, &c.	38,200,000
Soap,	5,000,000
Sugar refineries,	4,800,000
Salt,	2,700,000
Tobacco,	1,200,000
Starch,	1,200,000
Fisheries,	20,000,000
Different other branches of art,	60,000,000
Total of manufactures, &c.	524,950,000
Produce of the agriculture of the colonies,	200,000,000
Houses and other buildings,	300,000,000
Articles omitted,	149,050,000
Total of agriculture, manufactures, colonial produce, &c.	3,000,000,000

In this general result, M. Arnold, in his treatise *De la Balance du Commerce de la France,* M. le Trosne *De l'Administration Provinciale,* 1788, and M. Dupont *Lettre a la Chambre du Commerce de Normandie,* nearly agree: the first gives the total at 3,400,000,000; M. le Trosne calculates it at 3,134,000,000; and M. Dupont at between 3,200,000,000 and 4,000,000,000.

CHAP. VII.

Population at different Periods—Wages—Poor—Fuel and Provisions—Religion—Finances before and since the Revolution—Army—Navy—Weights, Measures, and Money—Language and Literature—National Character.

Statistics. Population.

There are scarcely any data, on which we can calculate the extent of the population of France, previously to the Revolution; yet it may be proper to notice some of the conjectures on this head. In 1577, the Duke of Nevers calculated that in the dominions of France, there were 3,000,000 of hearths; if we estimate each of them at six persons to a family, it will give a population of only 18,000,000. But at this period, neither French Flanders, Artois, Alsace, nor Lorraine, nor the counties of Burgundy, Rousillon, Ardagne, nor Bearn, were included in the monarchy. In 1581, the whole kingdom contained 96 bishoprics, and 132,000 parishes and hamlets. At the conclusion of the 17th century, it would appear from the reports of the intendants of the several provinces, that the population of France had not increased, since by them it is rated only at 20,093,000; and at this period great additions had been made to the territories of France. In the year 1754, the Marquis de Mirabeau rated the whole population still lower, viz. at 18,000,000. In 1772, the Abbè d'Expilly estimated it at 22,140,357; and nearly at the same period, Buffon estimated it at 21,672,777. In 1785, Neckar rated it at 24,676,000. In 1789, M. Bouvaliet Desbroges estimated it at 27,957,267; and in 1791, the Committee of the National Assembly, from a more accurate calculation, stated it to be 26,363,074. In 1798, according to M. Prony, the population of France, including Corsica and the conquered countries, amounted to 31,123,218; viz. 26,048, 254 in the territories of ancient France; 3,511,055 in the Venaisin, Savoy, Nice, Geneva, the Austrian Netherlands, &c.; and 1,563,909 in the countries situated between the Rhine and the Moselle. In 1799, M. D'epere, in his report to the Council of Five Hundred, stated it at 33,501,694. The senatus consultum of the 4th of August 1802, made the whole population of France amount to 33,111,962. This number, however, does not include Piedmont and the Isle of Elba. From these and other data, we may safely conclude, that the population of the kingdom of France, within the limits now prescribed to it, is nearly 26,000,000; or, that if the destruction caused by the ambition of Bonaparte has reduced it below that amount, it will soon rise to it again.

Of the 26,363,074 inhabitants which, according to the report of the committee of the National Assembly, constituted the population of France in the year 1791, 5,709,270 were inhabitants of the cities, towns, &c. and 20,521,538 were inhabitants of the country. From this it appears, that at this period less than one-fourth of the people inhabited towns; and from Mr Birkbeck's remarks, it is evident that this is the case at present, at least to an equal degree. His observations deserve to be quoted. "The population of France seems to be arranged thus: a town (Moulins for instance) depends for subsistence on the lands immediately surrounding it. The cultivators, individually, have not much to spare; because, as their husbandry is a sort of gardening, it requires a large country population, and has in proportion less superfluity of produce. Thus is formed a numerous but poor country population. The daily supply of the numberless petty articles of French diet, employs and therefore produces a multitude of little traders. It must be brought daily from the country; and the number of individuals whom this operation employs is beyond calculation. Multitudes, again, make a scanty living, by retailing through the streets these low-priced and perishable articles. The cultivator receives payment for his surplus produce in sous, and he expends only sous. The tradesman is on a par with the farmer; as they receive, so they spend. And thus

50,000 persons may inhabit a district, with a town of 10,000 persons in the centre of it; bartering the superfluity of the country for the arts and manufactures of the town. Poor from generation to generation, and growing continually poorer as they increase in numbers, in the country, by the division and subdivision of property; in the town, by the division and subdivision of trades and professions."

The following Table exhibits the population of different districts of France, as it existed at the end of the 17th century, and a few years previous to the Revolution; with the number of people to the square league, at each period, and the increase in the latter period. It may be proper to premise, that the population of the former period is taken from the report of the Intendants, and that of the latter period from the book of the administration of the finances of France.

Districts.	Square Leagues.	Inhabitants at the end of the 17th century.	Inhabitants to the square league.	Inhabitants a few years before the Revolution.	Inhabitants to the square league.	Increase.
Maritime districts, ...	10538	8,775,000	832	10,180,000	966	134
Frontiers, comprising Lorraine, .	7848	4,383,000	583	6,132,000	781	198
Interior districts, ...	6991	4,995,000	714	5,949,000	850	136
District of Paris, ...	1157	1,577,000	1363	1,782,000	1540	177
District of Lyons, ...	416	363,000	875	634,000	1522	647
	26,950	20,093,000	782	24,677,000	915	133

Assuming the population in 1802 to have been 33,111,962, including all the territories at that time annexed, except Piedmont and the Isle of Elba, French and Austrian Flanders, which comprised the departments of the Scheldt, the Lys, and the North, contained 1,748,669 inhabitants within a territory of 4136$\frac{1}{2}$ miles, which is somewhat more than 422 inhabitants per square mile. The population of the country round Paris, notwithstanding the weight of that city in the scale, was inferior. If we take the two departments of the Seine, and the Seine and Oise, the department of the Marne, exclusive of the district of Fountainebleau, and besides the two districts of Beauvais and Senlis, which belong to the department of the Oise, we shall find in 1802 only a population of 1,496,223 over an extent of 4198$\frac{2}{7}$ square miles. Next to Flanders, Normandy is the most populous district in France. The five departments of which it is composed, exhibit a population of 2,465,507 souls, in 1802, over a surface of 9175$\frac{4}{6}$ square miles, equal to 268$\frac{4}{7}$ inhabitants per mile. The population of the south-east of France, on the contrary, is very small. In the three departments of the Alps there was not in 1802 more than 80 inhabitants per mile. The population of the Pyrenees was also very thin, though superior to that of the Alps. The three departments of the Pyrenees and that of the Arriege contained 900,167 inhabitants over an extent of 6532$\frac{1}{2}$ square miles, or nearly 138 per square mile. The most populous of all the departments, to the south of the 48 degree of latitude, is that of the Mouths of the Rhone, which, however, in 1802, contained only 320,072 inhabitants over a territory of 1550$\frac{2}{7}$ square miles, or about 205 inhabitants per square mile. The population of most of the rest of the departments in this portion of France was very inconsiderable: if, for instance, the eleven departments of Aude, Aveyron, Cher, Drome, Indre, Landes, Loire and Cher, Logere, Nievre, Var, and Vienne, be taken together, their population in 1802 will be found to be only 2,599,911 inhabitants over 23,778 square miles; that is, 109 inhabitants per square mile, which is little more than one-fourth of the population of Flanders. If the population of these eleven departments be added to that above stated of the Alps and the Pyrenees, it will appear that in 1802, there were only 3,017,320 inhabitants over a territory of 126,869 kilometers; whence it appears that this southern part of France contained then only the eleventh part of its inhabitants, notwithstanding it is one fifth of its extent. Thus it appears, that although one third part of France, as it existed in 1802, only lay on the north of the parallel of Paris, yet the population of the northern part, Paris included, was not much inferior to the southern division. Taking the whole population of France as it was in the beginning of 1802, when its territorial extent was 30,505 square leagues, it gives 1086 inhabitants for the square league. Estimating the acres at 131,722,295, and taking the population to be, as it was in the beginning of the Revolution, 26,363,074, there will at present be nearly five acres a head.

In 1802, Paris was calculated to contain 546,856 inhabitants; there were 3 cities, that contained above 100,000 each, viz. Bourdeaux, Marseilles, and Lyons; 8, from 100,000 to 50,000; but in these were included Antwerp, Brussels, Ghent, and Liege; 12, from 50,000 to 30,000; but in these also were included Cologne and Bruges; 22, from 30,000 to 20,000; 24, from 20,000 to 15,000; and 45, from 15,000 to 10,000. In short, at this period there were calculated to be 500 towns in the French republic as it then existed, containing 5,405,119 inhabitants.

Births, Marriages, and Deaths.

The annual number of births in France is as 1 to 25: and of these every 47th child in 1780 was illegitimate; the proportion of illegitimate children since the Revolution has very much increased, the calculation being that every 11th child is now illegitimate. The number of marriages is as 1 to 110. The number of deaths is as 1 to 30. The prefect of the department of the Doubs, on comparing the accounts of the children that died under 10 years of age in 1800, and of those that died under 10 years of age in 1802, found that 939 more children had died in that single department in 1800 than in 1802, and ascribed the difference to the great progress which vaccine inoculation had made in the latter period. In 1801, M. Morgues published a statistical Essay, containing the result of 21 years observations on the relative and actual number of births, deaths, and marriages at Montpellier, from 1771 to 1792. The average of the whole population, during the whole 21 years, was 32,897: during the three autumnal months there were one-fourth more births than during the three spring months; yet the greatest number of births was in January, and the least in June. The average annual births were 1107 or $\frac{1}{27}$, one-half of

Statistics.

the whole population. The number of males born was to that of females as 20 to $21\frac{3}{4}$. The illegitimate children formed $\frac{1}{9}$th of the whole annual reproduction, whereas in Paris they formed $\frac{1}{4}$th. The number of marriages was 282, which to the whole population was as 1 to 118: of these that were born, 1 in $2\frac{1}{7}$ was married. The number of deaths each year was 1112; and their proportion to the whole population was as 1 to $29\frac{1}{2}$: of these 546 were children under 10 years old. Winter and spring were the healthiest seasons. The burials in August were to those in May, as $3\frac{1}{4}$ to 2. In 1774, 1778, and 1783, the small-pox was epidemic, and in those years the annual mortality was increased by 423 children. In the 21 years above mentioned, three men and 13 women died at the age of 100 and upwards; and one person in $7\frac{1}{2}$ arrived at the age of 70.

Condition of the people.

The condition of the great mass of the people in France, with respect to their pecuniary circumstances, since the Revolution, may be regarded as on the whole improved; but at the same time, it indicates a state of society by no means far advanced. The peasantry in most places, as well as the small class of farmers, and even the more extensive class of farmers in some parts of the kingdom, grow, or make within themselves, nearly all that their families consume, or wear; the same comparatively little advanced state of society is indicated by the not uncommon mode of paying for labour by a part of what it produces or performs. With respect to pecuniary wages, they are nominally lower, not in fact higher than they are in England; for though the money given is less, yet from the cheapness of provisions, &c. it commands more of the necessaries and comforts of life. In France, however, as probably in all countries, at least in Europe, not only the nominal but the real rate of wages has increased gradually for a considerable length of time, and perhaps in a greater proportion, within these last 30 years.

Prices of labour.

In 1756, the price of labour at the places mentioned below, was as follows: At Lisle, the wages of journeymen stocking and camlet weavers, was about 24 sous per day, that is about 13d. English: the journeymen weavers and cloth-workers at Abbeville gained, according to the nature of their work, and their dexterity, from 20 to 50 sous a day; whereas women, at the same place, engaged in the same manufacture, did not gain more than 12 sous a-day. Hedgers and ditchers in the country only 10 sous a-day. At Nantes, the journeymen ship carpenters, about 30 sous a-day. At Castelnandary, labourers, mending the canal of Languedoc, by the job, earned about 12 sous a-day. At Nismes, journeymen weavers in the silk and cotton trade, from 30 to 35 sous a-day. At Marseilles journeymen tailors 30 sous a-day. At the same place, carpenters 30 sous; silk weavers from 30 to 35 sous. At Toulon, journeymen carpenters, in the King's yards, 30 sous per day. At Lyons, journeymen workmen had several prices, according to the silks, velvets, gold stuffs, laces, &c. from 50 to 100 sous a-day. Land carriage of goods, from Marseilles to Lyons, 230 miles, from six to seven livres, per 108 libs. English, (Tucker's *Essay on Trade*, p. 75.) When Mr Young travelled in France, immediately before the Revolution, he averaged the earnings on all the fabrics manufactured in that kingdom, at 26 sous for the men, and 15 sous for the women; the wages of the spinners being nine sous. At the same time he calculated the wages of the men employed in the manufactures of England to average 20d. a-day, or rather more than 40 sous; the women 9d. or rather more than 18 sous; and the spinners $6\frac{1}{4}$d. or about 13 sous. On a comparison of these prices, it appears, that, at this period, the wages of the men in England was nearly double the wages of the men in France, whereas the wages of the women in the former country was little more than what it was in France. The average earnings of men throughout the kingdom, employed in all sorts of work, Mr Young estimated at 19 sous; masons and carpenters, however, got 30 sous: He considered that the price of labour had risen about 20 per cent. in the course of 25 years. The same author calculated the average rate of wages for all kinds of labour in England, to be, about 1760, 1s. 3d. a-day; and in 1789, when he travelled in France, about 1s. $4\frac{3}{4}$d. a-day. The result of his enquiries respecting the comparative price of meat and bread and the rate of wages in the two countries, in 1789, was, that labour in England averaged $33\frac{1}{2}$ sous, while meat was $8\frac{1}{2}$ sous, and bread $3\frac{1}{2}$ sous per pound; whereas in France, labour averaged 19 sous, and meat was 7 sous, and bread 2 sous the pound. Hence it appears, that the nominal price of labour was nearly 76 per cent. cheaper in France than in England; and the real price, considered with reference to its command over meat, was less, while its real price, considered with regard to its command over bread, was nearly the same in both countries. In 1814, Mr Birkbeck seems to have taken a good deal of pains to ascertain the comparative price of labour and provisions in France. He found that, at Rouen, women who attended the looms earned 15d. per day, equal to 11 pounds of bread; the labourers employed by a small farmer in the neighbourhood of that place, had 10d. per day, and their board; and 20d. per day without board. On this he remarks, that, "as all provisions, every article of expenditure, may be taken at something under half the English price, by doubling their wages, we may find the proportion they bear to ours." In the south of France, near Vienne, the French labourer received three bushels and one-third for harvesting and thrashing, for every 18 bushels thrashed; the English labourer receives for the same work only about a tenth: money wages are nearly in the same proportion. About Lunel, the wages were 20d. per day for the men, and from 10d. to 15d. per day for the women employed in agriculture; the former rate, considering the price of provisions, Mr Birkbeck considers as equal to 3s. 4d. in England.

State of the poor.

Before the Revolution, the poor in France were universally supported, either by the ecclesiastics, or by begging. Not long after the seisure of the ecclesiastical estates, the National Assembly publicly declared, that they would consider the care of the poor as one of their primary duties. They appointed also a committee of *mendicati*, whose business was to enquire into, and report to the Assembly, the state of the poor, and the best means of extinguishing indigence in France. Of this committee the Duke of Liancourt was the chairman. Four reports were laid before the Assembly; in their third report, the committee examine the idea of establishing a poor's rate, but with great wisdom absolutely reject it. In their fourth report, however, they declare that the poor have a right to pecuniary assistance from the state; that the National Assembly ought to consider such provision as one of its first and most sacred duties; and that an expence, with this view, ought to be incurred, to the amount of 50 millions of livres a-year. The unsettled state of France, however, seems to have prevented the execution of any plan founded on this report; and, at present, the poor are supported in the following manner. In large towns there are generally two hospitals, one for the indigent sick, the other for the aged poor; these are supported by a small duty paid at the entrance of these towns, on all kinds of provisions, called *l'Octroi de Bienfaisance*; or rather, these octrois provide for the whole public expenditure, and part of the receipt is applied to the maintenance of the hospitals. A contribution, purely voluntary, is also made for the same purpose. In country communes, there is no regular provision; but, in cases of extraordinary distress, the mayor and council of every commune are authorised to apply relief.

Fuel. Food. Dress. ottages.

Wood is the common fuel throughout France, and in some parts, especially in Paris, is a very expensive article. Coal, though, as we have already seen, it is by no means scarce, is seldom used, a prejudice existing against it: where turf or peat is found, it is used. The common people in general consume but little meat; bread made of rye, of rye and wheat, or of barley and wheat, chesnuts, maise prepared in different ways, and fruit, are their usual food: they drink but little wine, even where it is cheap and abundant. Their cloths being mostly made of materials grown by themselves, are coarse, but they are better supplied, especially with linen, than the peasantry of England. To a person who has been accustomed to see nearly the same mode of dress in all parts of England, even the most remote, it seems singular to observe in France such a diversity of fashions: so little is the intercourse even between the capital and the adjacent provinces, that, in the latter, modes of dress are seen which have not prevailed in the former probably for nearly a century. The cottages of the peasantry are in general small; but in many parts of France by no means destitute of convenience or taste. In many of the vine provinces, the *Vignerons* inhabit cottages dug out of the sides of the chalk hills.

cclesiasti-
l state.

Before the Revolution, there were 18 archbishops and 112 bishops in France, besides six suffragan bishops. The number of parishes at that time was 40,000. There were 800 convents of monks, 281 nunneries, and 679 chapters. The number of religious of all orders, and of both sexes, has been variously estimated, and of course varied; but the general opinion is, that the total number of male religious was about 130,000, and of female about 82,000. There is also great uncertainty respecting the amount of the revenue of the clergy before the Revolution: Mr Neckar calculates it at £5,687,500 sterling, of which the cures of parishes had £1,859,375.

At present, the Roman Catholic religion is declared that of the majority of the French people, and it is supported by the state; but the state provides equally for the ministers of the reformed church, either of the Lutheran or Calvinistic confession, and superintends even the synagogues of the Jews. The difference in religion is no bar to the advancement of any French citizen to the highest offices in the state.

By a decree of the National Assembly of the 12th July 1790, the archbishops were reduced to 10, and the bishoprics to 83; but, in conformity with the concordat concluded on the 25th July 1801, a new ecclesiastical division was adopted, which established 10 archbishops and 51 bishops in France proper.

As the constitution of France is yet unfixed, or, at least, is liable to alteration, we shall not pretend to give even a sketch of it; but as the arrangements for the internal government of the country will probably be permitted to remain, they may be shortly mentioned; premising, that there are ten ministers and one secretary of state, viz. a minister for the department of the administration of justice, called the Great Judge; a minister for the foreign department—for the home department—for the financial administration of the kingdom—a chancellor of the exchequer—a war minister—for the administration of the war department—for the administration of naval and colonial affairs—for the general police of the kingdom—and for the religious institutions of the country. There is an inferior court of justice in every district, and a justice of the peace in every canton. There are a number of courts of appeal, and two supreme tribunals. Each department is administered by a prefect, and as many subprefects as it contains districts. The details of the administration descend from the subprefects to the mayors, who are not chosen by the people, but by the government.

Taxes.

The taxes paid before the Revolution may be classed under the five heads of direct taxes, monopolies, duties of excise, custom and transit duties, and stamps. The produce of the direct taxes amounted to about one-third of the whole revenue. One of these, the capitation tax, which fell very lightly on the nobility, and not at all on the clergy, yielded about one-fifth of this sum. The other direct taxes were the *vingtiemes*, which nearly resembled the English land-tax—and the *taille*, another species of land-tax, so unequally levied, that it fell almost exclusively on the poorer proprietors. The monopolies were that of salt, which, under the name of *gabelle*, was levied by government on about two-thirds of the kingdom; that of snuff, and that of brandy and other spirits, which was levied only in certain provinces. The excise comprehended taxes on leather, on the manufacture of starch, and of cards, on iron, oil, &c. besides other contributions. The transit duties included not only the customs payable on the export and import of merchandise at the sea ports, but also those which were levied at the gates of the towns, and a variety of tolls of different kinds. The stamp duties were levied on almost all kinds of contracts, and affected all changes of property. Under the old monarchy, according to Neckar, the expences of collection amounted to 10¼ per cent. on all the taxes paid by the people. At this period, the farmers-general, the general and particular receivers, and all the subalterns in the service of the treasury, advanced sums to the government as securities for the faithful discharge of their trust. For these securities they were paid an interest of 5 per cent. and in some cases of 7.

The following were the taxes on land under the old government, according to Mr Young.

Taxes on Land.	French Money. Livres.	English Money.
Vingtiemes	55,565,264	£2,430,980
Taille	81,000,000	3,543,750
Local impositions . .	1,800,000	78,750
Capitation	22,000,000	962,500
Decimes	10,600,090	463,750
Sundries	60,000	26,250
	171,565,264	£7,505,980

Statistics.
Taxes.

Taxes on Consumption.	French Money. Livres.	English Money.
Salt	58,560,000	£2,562,000
Wine, Brandy, &c.	56,250,181	2,460,444
Tobacco	27,000,000	1,181,205
Leather	5,850,008	255,937
Paper and Cards	1,081,509	47,315
Starch and Powder	758,049	33,164
Iron	980,000	42,875
Oil	763,000	33,381
Glass	150,000	6,562
Soap	838,971	36,704
Linen and Stuffs	150,000	6,562
Octrois, &c.	57,561,552	2,518,317
Cattle	630,000	27,562
Customs	23,440,000	1,025,500
Tolls	5,000,000	218,750
Stamps	20,241,473	885,695
Local duties	1,133,162	49,575
	260,390,905	£11,391,548

General Revenue.

Taxes on land	171,565,264	£7,505,980
Domaines	9,900,000	433,125
Consumption	260,390,905	11,391,548
Personal	44,240,000	1,935,500
Monopolies	28,513,774	1,247,496
Sundries	12,580,000	550,375
Taxes not received on account of government	95,900,000	4,195,625
	622,999,943	£27,259,649

At the Revolution, the taxes of excise were completely abolished, and all the other indirect taxes materially simplified. The present regular revenue is derived from a land-tax, which is about 15 per cent. both for landlord and tenant; a personal tax; a tax on moveables and sumptuaries; on houses and windows; on patentees; on the privilege of exercising any profession; additional centimes or hundreds; from the produce of the national domains and forests; customs, post-office, lottery, salt mines, &c. All these taxes in 1803, produced a total sum of 569,500,000 francs. The expenditure the same year amounted to 589,500,000 francs. The expence of collection was between 15 and 16 per cent. It was calculated by the minister of finance, in this year, that the capital value of the real property of France was at least 30 milliards of francs.

Every village and commune of France has a collector or tax gatherer, who pays over the amount of his receipts to a treasurer, called a particular receiver, of whom there is one for every district. There is also a receiver-general for each department, into whose hands the particular receiver pays the sums drawn from the collectors, and who communicate directly with the treasury. They are all under the superintendance of an administration, entitled the Direction of the Taxes. In 1805, the number of chief officers belonging to the direction of taxes, amounted, throughout the empire, without including Piedmont, to 1044.

Statistics.

It must be evident, that it is scarcely possible to gain an accurate idea of the revenue or expenditure of a country situated as France has been since the Revolution, and especially during the latter part of Bonaparte's reign; for, in the first place, the annual reports were evidently made up for the purposes of deceit; and, in the second place, had they been impartial, no conclusion of general importance could have been drawn from them, as so much of the wealth of France, or rather of the means of defraying her enormous expenditure, was drawn from plunder. Even the finance report of 1814, after the abdication of Bonaparte, must be received with caution; since the framers of it undoubtedly wished to exaggerate the evils his tyranny had caused, and, besides, hardly gave themselves sufficient leisure to gain an accurate knowledge of the real state of the finances. Premising these reasons for caution, we shall give some of the details of this report for 1814. The budget of the minister of the interior, states the mass of all the funds appropriated to the different services of that department, amounted, in 1811, to 143,000,000; in 1812, to 150,000,000; and in 1813, to 140,000,000. The public treasury never contributed to this mass of funds more than 60,000,000; the remainder arose from special duties and imposts. Till the accession of Louis, it was not known that the budgets of 1812-13 presented a deficit of 312,000,000. Till the commencement of the war in the Peninsula, all deficiencies were more than covered by foreign pillage: after that, while the expences increased by the wars, the revenue fell off; so that, in a very few years, there was an addition to the national debt of 1,645,469,000 francs; the perpetual annuities alone, which he found it necessary to give, amounting to 47,000,000, equal to a capital of 800,000,000. One half of these, however, were employed in paying off former debts. The whole of the *demandable* debt, at the accession of Louis, amounted to 759,000,000 francs: at the time of the Revolution, it exceeded three milliards, or 3,000,000,000 of francs. The receipts of 1814 were calculated by the minister of finance at 520,000,000; the expenditure at 827,415,000, leaving a deficit of 307,415,000. The expences of 1815 were calculated at 547,700,000; and the following were the ways and means proposed to meet these expences. Direct contributions, 340,000,000; registry, domains, and woods, (the domainal forests still amounting to 1,400,000 hectares), 120,000,000; posts, lottery, salt-works, tolls on navigation, and incidental receipts, 28,000,000; indirect contributions, 130,000,000; making a total of 618,000,000. We have given these calculations, though subsequent events rendered it impossible that they should be realized, because they exhibit a probable picture of what will be the resources and expenditure of France, when that kingdom is restored to tranquillity.

Revenue and expenditure.

Circulating medium.

The amount of specie existing in France before the Revolution, was estimated by Neckar at 2,200,000,000 francs. In the year 1789, it is stated by Bouvallet Desbrosses, in his *Tableau des Richesses de la France*, at 2,474,254,960 livres, 350,000,000 of which consisted in notes of the Caisse d'Escompte. In the year 1807, Peuchet, in his *Statistique de la France*, supposes it to have amounted, within the limits of the old territory, to 1,850,000,000. In 1789, it was calculated, that, in the maritime departments, the circulating medium amounted to 1,058,838,350 livres; and the business transacted by its means, to 4,485,600,000,000 livres. In those on the boundaries of France, the money in circulation amounted only to 385,227,000 livres, and the business done with it to 453,600,000. In the central departments, the circulating medium was 1,035,189,600 livres; and the trade carried on with it amounted to 11,874,600,000 livres.

Bank of France.

The bank of France was established in 1801, or rather it was new-modelled then, with a capital stock of 30,000,000 of francs in specie, made up of 30,000 shares of 1000 francs each. The amount of its notes in circulation was generally about 4,000,000 sterling: its dividend has always exceeded 5 per cent.; but only that sum was paid, the surplus being reserved as a stock when the dividend might be under 5 per cent. Its notes are not a legal tender: it discounts the acceptances of government and individuals; and receives deposits of sums not below 50 francs, for which it gives recognizances bearing interest. Its general assembly is composed of 200 holders, each of five shares or above, who elect fifteen directors and three censors, each of whom must be holders of at least thirty shares. Between 1783 and 1803, the bank of France was exposed to four temporary suspensions, viz. in 1783, 1787, 1798, and 1802. In 1806, a much more serious stoppage took place; and again, in 1814, when the allies entered France, and just before Bonaparte left Paris, to put himself at the head of his army.

Public funds.

The public funds of France consist of, 1st, Bank shares, or *actions de la banque*, as they are called; and, 2d, Third consolidated, or *tiers consolidé*. The latter is a 5 per cent. stock. The bank stock is disposed of in shares, or actions of 1000 francs each.

Land forces.

On the 1st of May 1814, the land forces of France amounted to more than 520,000 men, including all descriptions. Besides this force, there were 122,597 military of all ranks enjoying half pay: in Prussia, Russia, Austria, and England, there were 160,000 prisoners. The pay of men in active service for the year 1814 amounted to 202,000,000 francs; the half pay to 34,000,000; making a total of 236,000,000 francs. The war of 1812-13 destroyed, in artillery and ammunition, 250,000,000;—and the fortified places in the countries ceded by France, in the treaty of Paris, cost, since the year 1804, 115,000,000.

Although we may now hope that the army of France, that dreadful engine by means of which Bonaparte inflicted on Europe so many evils, is put beyond the power of farther mischief, yet it may not be uninteresting to notice its constitution during the period of its most formidable strength. There were generally 90 infantry regiments, each at 3230 men each; 27 regiments of light infantry, at the same number of men each; 2 regiments of carabineers; 12 regiments of cuirassiers; 30 regiments of dragoons; 24 regiments of chasseurs; 10 regiments of hussars; 8 regiments of artillery on foot; 6 regiments of horse artillery; 22 battalions of the artillery train; 16 companies of artillery labourers; 2 battalions of pontooners; 9 companies of miners; 5 battalions of sappers; 1 battalion of *gardes du genie*. These were commanded by 15 marshals of the empire, 150 generals of division, 300 generals of brigade, and 135 adjutants-commandants. The army was recruited by voluntary enlistings, and by a rigorous concription, which comprised all Frenchmen from the age of 20 to 25, without any distinction of rank, fortune, or business. Every soldier might rise to the highest rank; no commission could be sold. The military spirit was also animated by the decoration of a military order, called the Legion of Honour, which is still retained. It was originally composed of 16 cohorts, possessed each of national domains to the amount of 200,000 francs annually. Each cohort consisted of 7 great or superior officers or dignitaries, 20 commanders, 30 officers, and 350 *legionarées*. The great officers had an annual income of 5000 francs; the commanders 2000; the officers 1000, and the legionaries 250. The knights of the legion of honour amount to between 6000 and 7000.

Naval force.

In the reign of Louis XIV. the French navy was strong enough to equip a fleet of 63 ships of the line, 7 frigates, 36 vessels armed *en flute*, and 14 cutters, under the orders of Tourville, in the year 1690. In 1704, the French fleet that fought the combined English and Dutch fleets consisted of 50 ships of the line, 8 frigates, and 9 fire-ships. In 1791, the French navy consisted of 73 ships of the line, 67 frigates, 19 cutters, 29 armed brigs, 7 gun-boats, besides several hospital ships, galliots, &c. But the war with England annihilated the navy of France. The efforts of Bonaparte, however, were incessantly directed to its re-establishment. According to the exposé for 1814, the most absurd of Bonaparte's schemes were those which related to the establishment of a numerous and powerful navy. Paris itself saw a dock-yard formed within its walls. And what now remains of all these armaments? The wrecks of some of the vessels and accounts, which prove that for the successive creation and destruction of this monstrous and useless flotilla, upwards of 150,000,000 francs have been sacrificed since 1803. The grand works executed at Cherbourg, and the fine squadron of Toulon, alone present useful results. All the arsenals are completely dilapidated; the immense naval stores collected by Louis XVI. are squandered; and during the last 15 years, France lost 43 ships of the line, 82 frigates, and 76 corvettes, which could not be replaced at an expence of 200,000,000. In 1814, the total debt of the navy amounted to 61,300,000 francs.

Weights and measures.

During the republican government, a system of uniform weights and measures was established upon a simple plan. The elementary measure is connected with the dimensions of the terrestrial globe. This measure, which is called *metre*, or *mésure par excellence*, is the ten millionth part of a quarter of the terrestrial meridian, that is, of the distance of the equator from the pole; it is equal to 3 feet $11\frac{44}{100}$ inches. The *arc* serves to measure the surface of the soil, in the same manner as the arpent; it is equal to 100 square metres, or $948\frac{11}{100}$ square feet. The *stere* is equal to a cubic metre, or $\frac{2027}{100000}$ cubic feet. The *litre* is the measure of capacity; it is equal to a cubic decimetre, or $50\frac{46}{100}$ cubic inches, or $\frac{1}{20}$th of the former pint of Paris. The *gramme* marks the weight; it is equal to the weight of a cubic centimetre of pure water, at its maximum of density. It has been found equal to 18.827 French grains, of which 5.76 make 472.5 English; and 489.5058 grammes make a pound of the standard of the mint at Paris.

These five primitive measures are successively multiplied or divided by 10, in order to form the greater or smaller measures, by analogy to the decimal system of arithmetic. The three divisors are *deci*, *centi*, and *milli*, expressing the tenth, hundredth, or thousandth part; thus decimetre is the 10th part of the metre, deciarc the 10th part of the arc, &c. The four multiplicators are *deca*, *hecto*, *kilio*, and *myria*, denoting ten times, hundred times, thousand times, and ten thousand times: thus the decametre is 10 metres, the hectarc 100 arcs, the kiliometre 1000 metres, the myriagramme 10,000 grammes.

Coins.

The standard coin of France is a piece of silver of the weight of five grammes, or five times 18$\frac{241}{1000}$ grains, containing $\frac{1}{10}$th of alloy and $\frac{9}{10}$ths of pure silver, and very nearly the 24th part of the pound sterling metallic value, being nearly the same with the livre tournois: it is called a franc, and divided into decimes and centimes. There are pieces of 5 francs, 2 francs, $\frac{3}{4}$, $\frac{1}{2}$ and $\frac{1}{4}$ franc. The gold coins, like the silver coin, contain $\frac{1}{10}$th of alloy and $\frac{9}{10}$ths of pure metal. They are called Napoleons d'or or octo grammes: an octo gramme of gold is worth 25 francs.

Language.

The basis of the French language is Latin, on which are engrafted Celtic and Gothic words and idioms. It is more remarkable for refinement and precision, than for energy or dignity. Their writers have rendered their language familiar to the lovers of literature throughout Europe; and in the value of their productions, they have no equals among the moderns, with the sole exception of the English. Even the mathematical sciences have been cultivated by them with a success, certainly not inferior to that of any other nation. Their taste in letters is purer than in the fine arts, in which there is a superabundance of ornament and an affected manner. Before the Revolution, there were 21 universities, and 39 academies and literary societies in France. During the Revolution a regular system of schools has been repeatedly decreed, though it does not appear that they have been actually established, or have at least proceeded so successfully and usefully, as the official reports represented. On the whole, however, education is more general now than it was previous to the Revolution.

Character of the French.

"The essence of the French character is an exuberance of animal spirits, producing excess of mobility, and a perpetual restless activity. They are quick, ingenious, fertile in expedients, buoyant against difficulty or adversity; but mutable, trifling, confident, vain, credulous, and incapable of moderation. With much that renders them amiable in society, as readiness to oblige, delicate attentions, kind sympathy, and lively sensibility, they are often of insecure commerce, from laxity of principle, unmeaning professions, jealous irritability, and a strong propensity to intrigue. Their feelings of every kind verge to excess; and there is nothing either good or bad, of which they are not capable, under the influence of their impetuous ardour. No cabinet has excited so much disturbance among the neighbouring states, from ambition and the spirit of intermeddling, as that of France; and we have seen, that no change of political system at home has made an alteration in their foreign policy. The French, beyond all people, are the creatures of society: by it their manners and sentiments are fashioned, and in it are centred their chief pleasures and gratifications. They would excel all nations in the art of conversation, were not the desire of shining too universal. The love of glory operates upon them with extraordinary force, and stimulates them to great exertions; but it is often attended with empty ostentation and gasconade."

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France ‖ Franconia.

FRANCE, Isle of. See Mauritius.

FRANCHE Compté, the name of one of the provinces into which France was divided before the Revolution. It now forms the departments of Doubs, Jura, and Saone. See France, p. 676.

FRANCIS. See France, p. 556—563.

FRANCONIA, a circle in the centre of Germany, and anciently a part of Thuringia, is situated between 48° 45′ and 50° 50′ North Latitude, and between 9° 20′ and 12° 10′ East Longitude from Greenwich. It extends in some places 140 miles from north to south, and between 90 and 115 from west to east. It contains 7744 geographical miles, and 1,000,000 of inhabitants. It is distributed into different states or principalities, namely those of ecclesiastical princes, of secular princes, and of imperial cities.

I. The states of the ecclesiastical princes are the bishoprics of Aichstadt, of Wurtzburg, of Bamberg, and the territories of the Grand Master of the Teutonic Order.

The bishopric of Aichstadt, or Eichsted, is situated in the south-east corner of the circle, and is a tolerably fruitful country, watered by the Altmuhl, Anlauter, Schwarsach, Sulz, and Retzat. Its principal towns are, Aichstadt (see Aichstadt), the episcopal residence, about 45 miles south of Nuremberg, remarkable chiefly for a curious piece of workmanship, in the church, called the sun of the holy sacrament, made of massy gold, and enriched with the most precious stones; Nassenfels, a borough and citadel, three leagues west of Ingolstadt, and in the south-east corner of the country where the ancient Aureatum was situated; Abenberg, a small town and castle, where the counts of the same name formerly had their residence, and near which is at present a glass foundery for mirrors; Herreeden, Ohrnbau, Spalt, and several other small towns.

The bishopric of Wurtzburg, situated towards the west part of the circle, extends about 90 miles from north to south, and 60 from west to east, and contains 262,000 inhabitants. It is watered by the Mayne, the Saal, the Tauber, and the Jaxt; abounds in grain, fruits, and pastures; and yields the best wine in Franconia. Its principal towns are, Wurtzburg, a well-built and well-fortified city, containing a cathedral, an episcopal palace, an university, an observatory, several monasteries and churches, and about 16,000 inhabitants; Heydinsfeld, a little town on the Mayne, surrounded with vineyards; Veits-Hocheim, a small place about four leagues below the capital, containing a palace of the bishop; Kissingen, a little town on the Saal, having several salt springs and medicinal waters in its neighbourhood; Nunnerstadt, a small town on the river Laur, containing a gymnasium, a cloister of the Augustine hermits, and a commandery of the Teutonic Order; Koenigshofen, a small fortified town on the Saal; Gerolshofen, an ancient town on the left of the Mayne, near to which are the ruins of the citadel of Zabelstein; Volkach, a town on the Mayne, four leagues north-east of Wurtzburg, which exports considerable quantities of wine; Tphofen, Kitzingen, Ochsenfurt, all celebrated for good wine, and situated on the Mayne; Homburg, Dettelbach, and a great number of small market-towns.

The bishopric of Bamberg, situated east and south of Wurtzburg, stretches upwards of 65 miles from south-west to north-east, is between 40 and 50 miles in breadth, and contains 195,000 inhabitants. It is divided into two equal parts by the river Rednitz, running from south to north, and falling at Bamberg into the Mayne, which waters the northern parts. The soil is generally fertile, producing abundance of grain, fruits, and wine; and near the capital there are so many trees of the laurel, fig, lemon, and orange, that it is sometimes called the little Italy of Germany. The principal towns are, Bamberg (see Bamberg), or Babenberg, the capital of the district, a tolerably well built city, containing a magnificent cathedral, a large episcopal palace, an university, several monasteries, &c. and about 16,600 inhabitants; Forchheim, a fortified town, about 20 miles south of Bamberg, defended by a strong castle, and containing 4000 inhabitants; Schesslitz, a neat town with a castle, two leagues north-east of the capital; Cronach, a meanly built but fortified town, situated on an eminence, and containing 4000 inhabitants; Lichtenfels, a trading place on the Mayne, 20 miles north-east of Bamberg; Upper Scheinfeld, Vilseck, &c.

The territories of the Teutonic Order, or Knights of the Virgin Mary, would form a considerable principality, if lying contiguous; but their estates are scattered throughout Germany, and consist of the masterdom of Mergentheim, and 12 bailiwicks. The bailiwick of Franconia is divided into 15 commanderies, named from the places where the property of the order is situated, Ellingen, Wiernsberg, Nuremberg, Wurtsburg, &c.

II. The states of the secular princes are chiefly those of Bayreuth, or Culmbach; Ansbach, or Onolsbach; Limburg, Schwarzenberg, Wertheim, Erbach, Henneberg, Hohenloe, and several others of trifling extent.

The principality of Bayreuth or Culmbach, belonging to the house of Brandenburg, borders on Bohemia, and extends upwards of 30 miles eastward, and 28 from north to south. It is generally fertile and well cultivated, diversified with mountains and plains, but in some tracts is remarkably hilly, rugged, and barren. The elevated ridge of Fichtelberg, or Mons Pomiferus, nearly 16 miles in length, and one of the highest mountains in Germany, contains mines of iron, copper, lead, antimony, &c. crystals and marbles of various colours, and gives rise to a number of rivers, especially the Mayne, Saal, Eger, and Nab. The whole principality contains about 205,000 inhabitants. Its principal towns are, Bareith or Bayreuth (see Bareith), the capital, and the residence of the Margrave, a considerable town, containing a palace, castle, academy, &c. and about 10,000 inhabitants; St George, a town situated on the small lake Weyher, and containing an elegant palace recently built; Culmbach, formerly the Margrave's residence, a small town, pleasantly situated, slightly fortified, and containing 2800 inhabitants; Himmelkron, a large village, with a palace of the prince, in a pleasant valley on the White Mayne; Hof, an ancient town on the Saal, containing 4700 people; Wunsiedel, a neat trading town on the Fichtelberg, containing 2400 inhabitants; Weissenstadt, a small town near the source of the Eger, in a wild and barren tract, formerly much famed for its mines of tin and copper; Creussen, a small place, remarkable for its fine earthen ware; Erlangen, (see Erlangen;) near the influx of the Schwabach into the Rednitz, eleven leagues south-west of Bayreuth, consists of two small towns, the most recent of which was built by the French refugees after the revocation of the edict of Nantes, and contains several handsome streets, an elegant palace of the Margrave, an university, manufactures of hats, stock-

Franconia.

ings, &c. and 8000 inhabitants; Neustadt, Bayersdorf, and a number of other market towns and large villages.

The principality of Ansbach, or Onolzbach, is bounded by the territories of Bayreuth, Bamberg, and Wurtzburg. It is generally fertile; but some parts are remarkably mountainous and sandy. It is watered by the Jaxt, the Rednitz, and the Altmuhl; and near the village of Graben, some remains may still be traced of the canal between the two last of these rivers, by which Charlemagne opened a communication, in 793, between the Danube and the Rhine. The principality contains 215,000 inhabitants; and its chief towns are, Ansbach, or Anspach, (see Anspach,) the residence of the Margrave, a well-built town containing 13,000 people, and situated in the centre of the country; Schwabach, a manufacturing town, situated on the river of the same name, about 18 miles east of the capital, containing 6000 inhabitants, and noted for its hardware, stockings, and tapestry; Wendelstein, a handsome town, seven miles east of the last mentioned place; Cadolsburg, a considerable town surrounded with walls, and defended by a castle; Furth, a well-built and trading borough, about five miles north of Nurnberg; Roth, a little manufacturing town seven leagues south-east of Anspach, famed for its weavers of stocking and lace, and for an imperial asylum for persons guilty of manslaughter; Uffenheim, a handsome and flourishing manufacturing town, with several good public buildings, about 25 miles north west of Anspach; Heilsbrun, Feuchtwang, &c.

The principality, or rather lordship of Limburg, lying south-west of Nurnberg, extends about 20 miles from north to south, and 18 from east to west. It contains 15,000 inhabitants; and its principal towns are, Upper Sontheim, Gaildorf, Markt-Einersheim, defended by a castle, and Sommerhausen, fortified with a rampart and ditch.

The county of Schwarzenberg, north-west of Nurnberg, and in the interior of the circle, is about 20 miles long and 5 broad. It contains 24,000 inhabitants; and its principal towns are, Markt-Schainfeld, Geiselwind, Markt-Brait, &c.

The county of Wertheim is situated between the territories of Mentz and the bishopric of Wurtzburg, and is traversed by the river Mayne. It yields a considerable produce of wine; and its chief places are, Wertheim, Remlingen, Freudenberg, Hochst, Helbach, and Branberg, formerly celebrated for its aqueducts, which were destroyed by Turenne in 1675.

The county of Erbach, nearly surrounded by the territories of the Lower Rhine, is about 20 miles in length and 16 in breadth; mountainous, but well cultivated, provided with quarries of stone and marble, and several good mines of iron. Its chief towns are, Erbach, an old town with a citadel and wall; Michelstadt, which has an iron foundery in its vicinity; Freienstein, Furstenau, &c.

The county of Henneberg, in the northern part of the circle, is about 40 miles from east to west, and from 20 to 30 from north to south, and is traversed by the river Werra. There are several forests and mountains, mines of iron, salt, and mineral springs in the country. Grain and tobacco are raised in the more level districts. It is divided into several portions belonging to the electoral houses of Saxony, Saxe-Weimar, Saxe-Gotha, Hesse-Cassel, &c. Its principal places are, Schleusinger, near the forest of Thuringia, containing 2200 people; Suhla, a manufacturing town three leagues farther north, containing 6000 inhabitants; Ilmenau, on the eastern border, with several mines of copper and silver; Meinungen, in the centre, seven leagues west from the last mentioned, containing 3500 people; Salzungen, near the north border, celebrated for its salt springs; Schmalkalden, a considerable manufacturing town, three leagues northward from Meinungen, and famed in history for the league of the Protestant princes in 1531.

The principality of Hohenloe, of a very irregular figure, is about 40 miles from east to west, and 25 from north to south. It is watered in the western part by the Kocher, and in the eastern by the Tauber and Wornitz. Its mountains afford various kinds of timber; its vallies are covered with excellent pastures; and its southern hills are clothed with vineyards. It contains 80,000 inhabitants. Its principal towns are, Oehringen, in the south-west corner, containing 3900 people; Frankenau, a considerable manufacturing place near the source of the Wornitz; Kunselsau, situated in a hilly quarter, and containing 2100 inhabitants; Ingelfingen, Kirchberg, &c.

Besides these, are the counties of Reineck and Castell, and the lordships of Hausen, Welsheim, Seinsheim, Reichelsberg, and Wesentheid, which are of very little extent, each containing only a small town, or a few villages.

The imperial cities are Rothenburg, an old and well-built town in the county of Anspach, containing 8000 inhabitants, surrounded by walls and strong towers; Windsheim, a small fortified place in the same county, containing 2500 people; Scheinfurt, a small fortified town on the Mayne; Weissenburg, a small place in the bishopric of Aichstadt; and Nurnberg, or Nuremberg, which will form the subject of a separate article. The more remarkable also of the towns here mentioned, will be found under their respective titles.

The districts of Bamberg and Wurtzburg, contain some of the best land in Germany, and abound in all the necessaries of life. The inhabitants are skilful in agriculture; but in manufactures, are very far behind their more northern neighbours. In the vicinity of Bamberg, the art of gardening is practised to a great extent; and immense quantities of small pickled girkins, the best onions in Germany, and especially liquorice roots, are carried as far as Holland as articles of trade. The common people believe that there is no liquorice in any other part of the world, and that the possession of this root was given to them as an exclusive privilege by St Cunigunda, who is interred in their cathedral. Notwithstanding, however, of the excellence of the soil, and the gentleness of their ecclesiastical rulers, the people in these two rich bishoprics are in general extremely poor; and more beggars are to be seen among them than in many of the less favoured districts. This has been ascribed partly to the dissipated and luxurious manners of the inhabitants, and to the numerous acts and institutions of charity, which the Roman Catholic system (the prevailing religion of the country) is supposed to produce.

In the territories of Bayreuth and Anspach, the bounties of nature are less liberally bestowed; but a greater spirit of industry prevails among the people; and the inhabitants, though loaded with taxes, are in much better circumstances than in the fertile districts of the southern states. In the smaller principalities, the people in general are subject to great oppression, especially those whose masters reside in the greater courts. They are not only thus deprived of the advantages which would arise from the rents and revenues being expended on the spot, but are also subjected to the tyranny and exactions of despotic deputies. See Playfair's *Geography*, vol. iv. and Reisbeck's *Travels through Germany*, vol. iii. (*q*)

FRANEKER, a town of Holland in West Friesland, situated in the district of Westergo, and in the canton of Franekeradeel. It stands about two leagues from the Zuyder Sea, near the canal which stretches between Leuwarden and Harlingen. Franeker is the second town, and one of the neatest in Friesland, being adorned with very fine buildings, both public and private. It is celebrated for its university, which possesses a fine library, and which was established in 1585 by the states, and by William Louis, Count of Nassau. It possesses also a castle, which was erected in the 15th century, and served as the residence of the governors of Friesland. Between Franeker and Harlingen, there are many tile-kilns, where varnished tiles of a deep colour are fabricated. About a league from the town is Kleins-Lankum, the residence of the celebrated Camper, and where one of his sons continues to increase the splendid collection of minerals and petrifactions begun by his father.

The mean temperature of this town, according to five years observations, was *52° 6′*. The maximum heat was 82°, and the greatest usual cold 12°. East Longitude *5° 28′*; and North Latitude *53° 11′*. (*w*)

FRANKFORT, on the Mayne, an imperial city in the circle of the Upper Rhine, is about 35 miles eastward of Mentz, and is situated in the centre of the finest district of Germany. It was anciently the residence of the Frankish monarchs, and is still the place where the electors of the empire hold their meeting for choosing an emperor. The city is large, and contains about 60,000 inhabitants, including the Jews. It is divided into two unequal parts by the river Mayne, over which there is a bridge composed of 14 arches. The town is well fortified, and is surrounded with a broad ditch very full of water. The ramparts are planted with limes, and afford agreeable walks to the inhabitants. Most of the houses are built of timber, lath, and plaster, and constructed in the antique form, having the upper stories projecting over the lower; but they are kept in good repair, and have always a fresh appearance. The principal houses are built of red or white stone, and many of them are splendid edifices. The principal streets are wide, and there are three spacious squares, which add greatly to the beauty of the place, and in which are situated the houses of the opulent merchants, and the palaces of the neighbouring princes. Considerable additions have lately been made to it, comprising a square and 18 streets, which are filled with inhabitants. The public buildings most worthy of notice, are the cathedral church of Bartholomew, and the Römer, or Stadhouse. The cathedral belongs to the Catholics, and is a large ancient Gothic structure, said to have been erected by Pepin of France, and enriched by Charlemagne; but it was completely plundered by Louis of Bavaria; and has neither statues, paintings, nor ornaments. The Römer, or town-house, is an immense Gothic pile, bearing the marks of great antiquity, and containing various chambers for the transactions of public business. In the chamber of the electors, are several good paintings; and the grand hall contains a regular series of portraits of all the German emperors, from the time of Conrad in the year 900. Among the archives, is deposited the famous golden bull of Charles IV. which contains the fundamental laws of the Germanic constitution, written on parchment, in High Dutch, says Bishop Burnet, (who confesses, however, that he did not see it,) but, according to Cogan, in the Latin language. The Lutheran church of St Katharine, is also a magnificent building, ornamented, says the prelate just quoted, with as much painting as any Popish church, and having a huge carved crucifix over the high altar. The pulpit is extremely fine, constructed of marble of different colours, nicely polished and joined. The city is not encumbered with suburbs; but is surrounded with the country seats and pleasure gardens of the richer inhabitants, intermixed with public houses and tea gardens, for the entertainment of the ordinary citizens. No town in Germany, or perhaps in Europe, is more celebrated for excellent inns; but there exists a very oppressive law, by which the innkeepers, except at the time of the fairs, can prevent strangers from occupying private lodgings, and compel them both to eat and to sleep in the taverns. Frankfort is one of the principal commercial towns in Germany; and many of its merchants are possessed of considerable wealth. Riesbeck reckons that there are 200 houses or companies, who have annual incomes of 100,000 guilders, or £10,000 sterling and upwards; and in furniture, equipage, and dress, there is a great appearance of affluence among the higher rank of citizens. The trade, however, is of a description unfavourable to the country; and Frankfort has been termed "the great canal by which the gold of the empire runs out." There are considerable manufactures of silk, cotton, linen, woollen, carpeting, porcelain, tobacco, iron ware, &c.; but the principal traders are little better than brokers, commissioning articles of internal consumption. The export of German commodities from this channel, scarcely amounts to one-tenth of the imports from other countries, which consist of all kinds of spices, female ornaments, handkerchiefs, silks, and the various articles of luxury, furnished by Italy, France, and Holland. As the way to the principal high roads of Germany lies through the direction of Frankfort, there is always a concourse of fashionable company in the town; and several thousands of strangers are attracted to its great fairs, where the southern parts of Germany are supplied with various commodities. Of these fairs, there are two in the year, one in the spring, and another in the autumn season. Its situation on the Mayne, and its proximity to the Rhine, renders it the magazine of all the merchandise which is conveyed by these rivers, to the different parts of Germany. Besides the number of traders (about 1600) and private purchasers, by whom these fairs are frequented, multitudes are attracted by the love of gaiety and amusement; and the city becomes, during their continuance, as much a scene of licentiousness as a mart of business. The municipal government of Frankfort is of a very mixed and intricate description; and warm contests are continually carrying on between the aristocratical and popular interests. The spirit of litigiousness is described as unusually prevalent in the place; and the annual expence of the law suits, in which the magistrates are uniformly engaged with the burghers of the city, or with the neighbouring princes, is estimated at 50,000 rix-dollars. The annual revenue is about 600,000 guilders, or L. 30,000 sterling, which is raised chiefly from the customs and excise; but partly from the contributions of the burghers. There are two rates of contribution, one of 50 and the other of 25 guilders per annum. The former is imposed upon those who have an annual income of 50,000 guilders and upwards; and the latter upon smaller incomes; but every person estimates his own property, and consequently taxes himself, which it sometimes becomes the interest of the merchants to fix at the higher, rather than the lower rate. The citizens who are not Lutherans, have greater taxes to pay, while they possess fewer privileges. The Calvinists are wholly excluded from the rights of burgesses; and the Catholics, though admitted to that distinction, are not allowed to take any share in the government. The inhabitants of this city have a peculiar institution, called colleges, or associations of persons of the same rank or profession, colleges of nobles, colleges of lawyers, colleges of physicians, colleges of booksellers, colleges of all orders and artists; so that a stranger, upon being introduced into any of these, finds himself instantly acquainted with the most respectable persons of his own station. Many of the wealthier inhabitants possess considerable private collections of paintings, and of natural curiosities. These they take great pleasure in exhibiting to strangers; but are apt to exhaust both the patience and politeness of the visitors, by their tedious description of the minutest articles. Many of the principal literary characters of Germany, and well-informed men in every branch of the arts and sciences, may be found in Frankfort; but the low state of religious toleration, indicates a tardy progress in the path of real civilization, and in the spirit of true Christianity. While in manners and conversation there is too great a degree of licence; there are, in the exercise of public rights, many partial and preposterous restrictions. The established religion is the Lutheran; but both the Catholics and Calvinists are nearly equal to them in number, and the latter rather superior in point of wealth. The Catholics enjoy their principles and observances in full liberty, and have numerous chapels, monasteries, and nunneries; and the Calvinists, who about 20 years ago were obliged to resort to Saxenhausen, a village on the opposite side of the Mayne, in order to observe public worship in peace and tranquillity, have now two handsome places of worship within the city, one German, the other French. There are 10,000 Jews in Frankfort, who have a considerable synagogue, and enjoy a precarious toleration. They are found too useful to be totally eradicated, but are often subjected to such oppressions, as the self-interest of their persecutors will permit. The streets, to which their residence is restricted, were formerly inclosed with walls in such a manner, that, if thought necessary, they could be imprisoned in a body by locking the gates; and their habitations were so crowded, that in seven of the houses, which scarcely occupied a space of fifty yards, and which happened to be burned down, there were found to have dwelt twelve hundred individuals. There is a law, which prohibits them from residing in any other part of the city, and even from appearing out of their own enclosure; but it is only occasionally enforced, and sometimes in order to extort money for the exemption. At other times they are forced out of their retreat, to perform the more servile offices, such as to carry water in cases of fire, &c. They are a most industrious people, and some of them possess considerable wealth. They are chiefly employed in selling toys, and dealing in old clothes, of which they receive vast quantities from England; but they refuse no kind of occupation, however degrading or dishonourable. "Those who go into their streets," says Riesbeck, "are in danger of being pressed to death by them. They fall upon strangers by dozens, and compel them to buy their wares. It is very difficult for a man to disentangle himself from them without the help of a good stick; and they call to strangers from the distance of three or four hundred paces." Since their quarter of the city, however, was nearly consumed by fire, they have been dispersed over all the town, which they greatly prefer to their old habitations. East Long. according to solar observations, 8° 36′, and North Lat. 50° 7′ 29″. See Küttner's *Travels through Denmark*, and *Guide des Voyageurs*, vol. ii. p. 75. Riesbeck's *Travels through Germany*, vol. iii. Cogan's *Journey on the Rhine*, vol. ii. Bishop Burnet's *Travels*; and *Letters on a Tour through Germany*. (q)

FRANKFORT, on the Oder, a city of Germany, in the circle of Upper Saxony, and middle mark of Brandenburg, is a well built and trading town about 18 leagues south-east of Berlin. It contains a cathedral, a bishop's palace, two colleges, and several churches. The churches are large and well built, and the bridge over the Oder is about 280 feet in length. A simple monument has been erected to the memory of the poet Kleist, by the lodge of free masons in this city, in 1778; and the place where Prince Leopold of Brunswick perished, in generously attempting to save a fellow-creature from the waves of the Oder, is distinguished by a beautiful monument of white marble. In one of the churches, the same humane act is commemorated by a painting from the pencil of Rode. There is also an academy, a society for promoting the arts and sciences, and a Calvinistic university, which was established in 1506 by the Elector Joachim and his brother Albert. There are three annual fairs in this city, and it draws considerable advantages from the navigation of the Oder, and the canal of Muhlrose, by which it has an indirect communication with the Baltic. The number of inhabitants is 10,000. East Long. according to sidereal observations, 14° 33′ 15″; and North Lat. 52° 22″ 8″. (q)

FRANKING of Letters. See Post-Office.

FRANKINCENSE. See Gums.

FRANKLIN, Benjamin, the celebrated American politician and philosopher, was born at Boston in New England, in the year 1706. He was the youngest son of Josiah Franklin, a silk dyer in Northamptonshire, who removed to America in 1682, where he embraced the occupation of a soap-boiler and tallow-chandler, reared a numerous family by honest industry, and was distinguished among his townsmen as a person of sound judgment, and sober piety. His other sons were put apprentices to different trades; but Benjamin was destined for the church; and, at the age of eight years, was sent to a grammar school. He was removed, however, at the end of the first year, to a school for writing and arithmetic; and at ten years of age, was taken home to assist in his father's occupation. From his earliest years he discovered a passionate love of reading, especially the accounts of voyages; and he mentions Plutarch's Lives, and De Foe's Essay on Projects, as among the few books of general information to which he had access. This inclination for books, and the strong aversion which he shewed to the occupation of his father, suggested the plan of binding him apprentice to one of his brothers, who had established a printing-house at Boston. In this situation, he had an opportunity of procuring better books, and pursued his studies with such avidity, that he frequently spent the whole night in reading. He soon began to commit his own thoughts to writing; and by making summaries of papers from the Spectator, which he afterwards endeavoured to expand, from recollection, into their original form, he laboured to improve his style without any other instructor. When about 16 years of age, he adopted, from some work which fell into his hands, the fancy of adhering exclusively to a vegetable diet; and proposed to his brother, that, if he would allow him per week one half of what was paid for his board, he would undertake to maintain himself. Out of this little fund, he contrived to purchase books, as well as to pay for his subsistence; and, by his new mode of living, saved much time for his favourite pursuits. "When my brother and his workmen left the printing-house to go to dinner, I remained behind; and dispatching my frugal meal, which frequently consisted of a biscuit only, or a slice of bread and a bunch of raisins, or a bun from the pastry-cook's, with a glass of water, I had the rest of the time, till their return, for study; and my progress therein was proportioned to that clearness of ideas and quickness of conception, which are the fruit of temperance in eating and drinking. By perusing the works of Shaftesbury and Collins, he became a sceptic in religion, and began to adopt the Socratic method of reasoning, especially on that topic, as at once the safest to himself, and the most embarrassing to his opponents, obtaining often in this manner victories, which, by his own confession, "neither his cause nor his arguments merited." Having sent to the newspaper, printed by his brother, several anonymous pieces, which were very favourably received by the critics of the place, he became a little more sensible of his own attainments, and could less easily brook the severe treatment which he frequently experienced as an apprentice. His brother, being of a passionate temper, and his own impertinence sometimes serving as a sufficient provocation, he was often punished with blows. Having, besides, given offence, by the freedom of some of his pieces in the newspapers, both to the friends of government and of religion, he determined to quit at once the service of his brother, and the place of his nativity; but, despairing of being able to gain his father's consent, he secretly sailed to New York at the age of 17 years, without the aid or approbation of his friends, and with no more money than what the sale of a few of his books could enable him to raise. Being disappointed in his hopes of employment in that city, he proceeded to Philadelphia, where he arrived after a fatiguing journey, weary and hungry, without an acquaintance in the place, and with no greater stock of money than a Dutch dollar in his pocket. He soon found employment as a journeyman printer; and his literary attainments having attracted the notice of the governor, Sir William Keith, he was encouraged, by the flattering promises of his patron, to conceive the design of commencing business on his own account; and at last, after a short delay, he accepted the offer of the governor to advance the necessary sum for his establishment in business, and sailed for London to purchase the materials of his intended printing-office. Upon his arrival in London, he found himself the dupe of false professions; and discovered that his friend Sir William Keith was either unable, or had never intended to furnish him with those letters of credit and recommendation upon which he relied. He therefore employed himself as a journeyman printer in London, that he might improve his knowledge of the profession; and never failed to recommend himself to those whom he served, by his assiduous application to business. After spending about 18 months in this manner, and increasing considerably his stock of knowledge by means of the acquaintance which he made with several literary characters, and the opportunities of reading which he enjoyed, he engaged himself as clerk to Mr Denham, a merchant of Philadelphia, and returned with him to that city in October 1726. But, in the beginning of the following year, he was deprived of this excellent friend by death, and was once more obliged to resume his occupation of printer, under his first employer in Philadelphia. In a short time, however, he opened a printing office in partnership with one of his fellow printers; and, by indefatigable industry, soon acquired a sufficiency of funds and of friends to undertake the whole of the business. About this time, he mentions, in his Memoirs, that he had for several years been completely unsettled in his belief of religious principles, and even of moral obligations; but having witnessed in many of his companions, the demoralizing influence of such opinions, he became practically convinced of the importance at least of truth and probity in the transactions of human life; and, though uninfluenced by any respect for revelation, he was preserved by the good effects, it may be supposed, of his pious education, from gross immorality or injustice, and confirmed in a serious resolution to pursue a course of undeviating uprightness. He soon acquired the reputation of a most industrious and punctual tradesman, and his friends and employers daily increased. He instituted, in 1728, a literary society named the Junto, which subsisted during the space of 40 years, and became the foundation of the American Philosophical Society. At the same time, he published a new periodical paper, to which he drew the attention of the public by his own ability in writing; and particularly brought himself into notice, by a pamphlet on the Nature and Necessity of a Paper Currency.

In 1730 he entered into the married state, and continued to prosper in business, to improve in knowledge, and to advance in public usefulness. He was chosen, first, printer, then clerk, and at length member of Assembly, in which he represented the city of Philadelphia for 14 years successively. He was indefatigable in suggesting various useful improvements and institutions for the benefit of the community: and particularly contributed to the formation of a "Library Company" in 1731; the establishment of an insurance office against damages by fire, in 1738; the enrolment of volunteers for the defence of the country in 1744; the foundation of an academy and charitable school in 1749, which afterwards was erected into a college or seminary of general learning; and the endowment of the Pennsylvania Hospital in 1750. He accomplished a beneficial reform in the police of the city; ministered to the daily comfort of his fellow citizens, by his improved plans of chimnies and fire places; and essentially promoted the interests of frugality and industry among the lower orders, by the publication of Poor Richard's Almanack. In the midst of these humble labours, he gave abundant evidence of his penetrating philosophical genius, by prosecuting a course of interesting experiments and discoveries on the subject of electricity, which, about the middle of the last century, had engaged so much of the attention of scientific enquirers: (See ELECTRICITY.) But, from the time that he became a member of the Assembly of Pennsylvania, in 1747, his attention was so much directed to public affairs, that the greater part of the remainder of his life was devoted to political pursuits. Keen contentions were then carrying on between the Assembly and the proprietaries of the provinces; and he soon became a leading character in opposition to the latter. He seldom spoke in the course of the debates which took place; and when he did rise to address the house, his speeches often consisted only of a single sentence or a well-told story, and were always expressed in the most concise and simple style. But his judgment was unusually penetrating; and he has frequently been known by a single observation, delivered in his plain manner, to decide the fate of an important question. In 1754, when a meeting of commissioners from the northern provinces was held at Albany, in order to concert measures of mutual defence against the French settlements and Indian tribes, Franklin attended as delegate from Pennsylvania, and produced a plan which has generally been called the "Albany plan of Union." Though unanimously approved by the commissioners, it was finally rejected both by the provincial Assemblies and the king's council, upon principles which seem to establish its excellence as a just medium between political extremes. By the ministry of Great Britain, it was considered as giving too much power to the representatives of the people; while it was rejected by every assembly as giving to the president-general, the representative of the crown, a disproportionate and dangerous influence. In the alarm which followed the defeat of Braddock in 1755, Franklin introduced a bill into the Assembly for organizing a kind of voluntary militia, and for some time acted as colonel of a regiment raised in Philadelphia; and, in 1757, he was chosen agent for the province of Pennsylvania to present a petition on the part of the Assembly to his Britannic Majesty, against the measures of the proprietaries. After much discussion before the Privy Council, the prayer of the petition was partially granted upon condition that Franklin would solemnly engage, that the assessment should be so levied as to bear equitably upon the estates of the proprietaries; a proposal which testified at least the high opinion entertained of his honour and integrity. He still remained at the court of Great Britain as agent for the province of Pennsylvania; and, in consequence of the knowledge and fidelity with which he conducted the interests of the colonies, he was soon appointed to the same office for the provinces of Massachussets, Maryland, and Georgia. He was now in a situation where his merits were sure of being duly appretiated, and where his claim to literary honours was fully acknowledged.

He was admitted a member of the Royal Society of London, and of similar institutions in other parts of Europe; and the degree of Doctor of Laws was conferred upon him by the universities of St Andrews, Edinburgh, and Oxford. He was soon engaged in a correspondence with the most eminent philosophers of Europe, and never desisted entirely from philosophical studies. It was during his residence in London that he directed his attention to the electrical properties of the tourmalin, the effects of cold produced by evaporation, the causes of the north-east storms in North America, and the construction of the musical glass instrument *the harmonica*. But his time was chiefly occupied with political objects; and a pamphlet which he published, on the importance of Canada to Great Britain, is supposed to have suggested the expedition under Wolfe for the conquest of that province. After his return to America, in 1762, the disputes between the proprietaries and the Assembly were again revived, and increased to such a degree, that, in 1764, a resolution was adopted by the latter, which Dr Franklin supported with all his ability, to petition the King for an alteration of the *proprietary* into a *regal* government. In the election which took place in the end of that year, the party of the proprietaries having gained a small majority in the city of Philadelphia, Dr Franklin lost his seat in the Assembly; but his friends in that house still holding the superiority, he was again appointed provincial agent at London. After his return thither, he was examined at the bar of the House of Commons on the expediency of the stamp act; and, on that occasion, gave a striking proof of the accuracy of his information, and the facility of his expression. In 1766, he made a visit to Holland and Germany, and, in the year following, to France, experiencing every where the most friendly reception from men of literature and science. In the progress of the disputes between Great Britain and the American colonies, he exerted himself to the utmost, both in his conversation and correspondence, to effect a change of measures, and to point out the evils which a perseverance in those that were adopted must ultimately produce. Finding all his endeavours to restore harmony entirely ineffectual, he returned to America, in the year 1775, immediately after the commencement of hostilities, and continued to bear a leading part in the memorable struggle, which terminated in the political independence of the colonies. He acted as envoy of the States, in all their most important negociations with Britain, with France, and other European powers; and, after his return to Philadelphia, in 1785, was elected president of the supreme executive council of that city. About three years afterwards, he withdrew from all concern in political affairs; but, under all the infirmities of age, aggravated by a painful disease, he was ready to co-operate in every measure of public or private good. He was president of the Philadelphia Society for alleviating the miseries of public prisons, and also of the Pennsylvania Society for promoting the abolition of slavery. One of his last public acts, was the signing of a memorial from the last mentioned association, to the House of Representatives; and the last production of his pen was an ironical defence of the slave trade, in the form of a speech, supposed to have been delivered in the Divan of Algiers; an inimitable parody of the arguments of the anti-abolitionists, and a striking evidence of the strength of intellect which he possessed to the last. During the concluding twelve months of his life, he was confined almost entirely to bed, by a calculous complaint, which had afflicted him for several years; but died at last of an imposthume in his lungs, in April 1790, in the 85th year of his age.

The life of Dr Franklin affords a striking proof of the influence in society of a sound understanding, united with steady industry, and supported by candid integrity; and presents a useful lesson to all young persons of unsteady principles and showy accomplishments. His writings and discoveries also, on so many subjects of practical utility, produced, without any advantages of regular education, or literary society, forcibly illustrate how far a vigorous and well-directed mind may carry its possessor, without the minutiæ of learning, and the theories of science. He has distinguished himself in various departments of knowledge, in natural philosophy, in political economy, in general literature, and in practical morality. His physical speculations were almost uniformly suggested by views of utility, and are distinguished by the unparalleled facility with which he conducts his reader from one step of the enquiry to another, without even seeming to be at any loss, or to exert any labour in the process. His political writings were directed too much to temporary questions, to be permanently interesting; but his pamphlet on Canada, and his papers on the "Albany plan of Union," have been recommended as valuable models of strong reasoning and popular eloquence. On the general doctrines of the principle of population, and the freedom of commerce, and the practical points of the corn-trade, and the theory of money, his sentiments are considered as correct and clear; but, on the more abstract subjects of the value of manufactures, and the effects of paper currency, he is thought to be inaccurate and superficial, not so much from any flaw in his deductions, as from the insufficiency of his data. On subjects of morality, especially on those virtues which apply to the great body of mankind, his compositions are admirably adapted to accomplish their object, by their clearness, their soundness, their kindliness, their concise expression, and pointed illustrations. In respect of literary qualities, his style is often deficient in elegance, sometimes both puerile and vulgar; but always distinguished by simplicity of language and perspicuity of statement. He has been called the most rational of all philosophers, never losing sight of common sense in any of his speculations, or yielding up his understanding either to enthusiasm or authority.* In his personal and moral character, he was distinguished by industry and application to whatever he undertook, by the most active observation of whatever was passing around him, by acuteness and penetration in all his intercourse with men, or enquiries after truth. He was modest and unassuming in proposing his sentiments, communicating even his greatest discoveries only as queries or conjectures; yet uniformly cheerful and playful in conversation, enlivening every topic with entertaining anecdotes and harmless pleasantries. He was actively benevolent, and invariably upright; and though, in the early part of his life, sceptical in religion, yet he became, in maturer years, more friendly to devout sentiments, and, contrary to the general opinion, is affirmed by his intimate friend Dr William Smith to have been a believer in divine revelation. The humble piety, at least, of the following acknowledgment, in his Memoirs written by himself, cannot be doubted, and is worthy of being recorded. "And here let me with all humility acknowledge, that to divine Providence I am indebted for the felicity I have hitherto enjoyed. It is that power alone which has furnished me with the means I have employed, and that has crowned them with success. My faith in this respect leads me to hope, though I cannot count upon it, that the divine goodness will still be exercised towards me, either by prolonging the duration of my happiness to the close of life, or by giving me fortitude to support any melancholy reverse which may happen to me as to many others. My future fortune is unknown but to Him, in whose hand is our destiny, and who can make our very afflictions subservient to our benefit." See *Life of Dr Franklin, written by himself, and continued by Dr Stuber;* and *Eulogium on Dr Franklin by Dr Smith.* (q)

FRANKS. See FRANCE, p. 543.

FRASCATI, the ancient *Tusculum*, is a town of Italy, in the Campagna di Roma, situated on the side of a hill about twelve miles from Rome. The modern town is situated much lower down than the ancient city, but still in such an elevated and airy situation as to justify the origin of its name. There is nothing remarkable, according to Mr Eustace, in the interior of the town; but it is encircled with villas of great beauty and magnificence. The town of Tusculum was destroyed in a civil contest by the Romans themselves about the year 1190, and its site was marked, when visited by Mr Eustace, by long lines of walls, and of shattered arches, intermingled with shrubs and bushes, even to the summit, and along the sides of the mountain. From this there is an extensive view in every direction. Towards the south-east is seen *Monto Catone* and the *Prata Porcia*, once the property of Cato. At Grotto Fenata, about 1½ mile distant, stood the favourite Tuscan villa of Cicero. It is now an abbey of Greek monks, and stands on one of the beautiful hills which form the Alban Mount. In opposition to the opinion of Dr Middleton and Mr Melmoth, Mr Eustace maintains, that not even a trace of the ruins of this villa is to be seen. The principal, perhaps the whole of the building, says Mr Eustace, still stood at the end of the 18th century, when St Nilen, a Greek monk from Calabria, fixed himself on the spot, and, after having demolished what remained of the villa, erected on its site, and probably with its materials, his monastery, which in process of time became a rich abbey, and as it was first founded, so it is still inhabited by Greek monks of the order of St Basil. At each end of the portico, is fixed in the wall a fragment of basso relievo; one represents a philosopher sitting with a scroll in his hand in a thinking posture; in the other are four figures supporting the feet of a fifth, of a colossal size, supposed to represent Ajax. These, with the beautiful pillars that support the church, are the only remnants of the decorations and furniture of the ancient villa. The church contains little remarkable, excepting the chapel of St Nilus, painted by Dominichino in a masterly style. The wall is separated into compartments, and in each compartment is represented one of the principal actions of the patron saint. The Demoniac Boy, near the altar, and St Nilus praying near the end of the chapel, are supposed to be the two best." See Eustace's *Travels*. (w)

FRASERBURG, a town of Scotland, in the county of Aberdeen, is situated on the south side of the point called Kinnaird's Head. The streets, which are spacious, intersect each other at right angles; and the houses, which are neatly built, are covered with slates and tiles. The prison and town house stand near the centre of the town. The cross is a fine hexagonal structure, with three equidistant hexagonal abutments. The ground area is about 500 feet, and a stone pillar, 12 feet in height, surmounts the whole. In the west end of the town stands an old quadrangular tower, of three stories, which is part of a large edifice, intended for a college, which Sir Alexander Fraser was empowered to erect by a charter from the crown in 1509. The harbour of Fraserburgh, though small, is nevertheless good, having from 11 to 16 feet of water, and admitting vessels of 300 tons. There is good anchorage in a bay contiguous to the harbour, of about three miles long, and one broad. Linen yarn is manufactured here to the extent of three or four thousand pounds annually. A light-house has lately been erected by government on the top of the old castle, situated on the promontory of Kinnaird's Head.

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* The latest and most complete edition of the Works of Dr Franklin is that which was published in London, in 3 vols 8vo. 1806.

[illegible] in private. Harassed by [illegible] violence of his father, disgusted by [illegible] in the way of his favourite stu[illegible] induced by some other reasons which [illegible] determined, he adopted a [illegible] in the year 1730, secretly to quit the Prus[illegible] as a private individual to [illegible] England. His intention having been dis[illegible] together with his travelling [illegible] Lieutenant Katt, a youth [illegible] was condemned to lose his head [illegible] and the young prince was compelled, by [illegible] to witness the untimely end of his [illegible] more potent one, he was himself im[illegible] for the space of six months; until, [illegible] interposed in his be[illegible] suffered death. He was then [illegible] greater liberty, but was still requi[illegible] about 18 months after his [illegible] reconciliation took place between [illegible] as it only partially restored [illegible] appeared at court, and resided [illegible] of Rheinsberg [illegible] enabled him to prosecute his studies with

[illegible] The greatest [illegible] the want of money, which [illegible] always [illegible] Duke of Courland. On the 1st [illegible] succeeded his father, as king of Pru[illegible] sion to the throne was welcomed by [illegible] clamations of his subjects.

Immediately after the funeral of [illegible] narch, he applied himself to public bu[illegible] without [illegible]; and, among other re[illegible] tuted a new order of knighthood, call[illegible] merit," with the professed design of re[illegible] rious individuals, without distinction of [illegible] or country. Soon after his accession, he [illegible] learned and scientific characters to his [illegible] establishing an acade[illegible] proceeded to visit [illegible] receive the [illegible] to Strasb[illegible]

[illegible] designated Frederick II. his father [illegible]

Frederick III.

might take a view of the French frontiers. He [illegible]ed to have proceeded to Paris, under his feigned [illegible] of the Count du Fom, but, having been recognised [illegible] his way, he turned aside to Cleves, where he had [illegible] first interview with Voltaire, whom he employed to publish his refutation of Machiavel, at the very moment when he was exemplifying the principles which he condemned, by levying a contribution on the city of Liege, and inforcing a questionable claim to the surrounding district. From the very commencement of his reign, he seems to have formed a plan for the increase of his territories; and, by the death of the Emperor of Germany, an extensive field was opened for the operations of his ambition. Disregarding the Pragmatic Sanction, by which all the powers of Europe had guaranteed the Emperor's hereditary dominions to his eldest daughter the Archduchess Maria Theresa, he revived some obsolete claims to the duchy of Silesia, and took immediate possession, with an army of 30,000. He made himself master of Glogau by surprise, defeated the Austrian army at Molwitz, reduced the cities of Brieg and Neiss, entered Breslaw, the capital, without opposition, and having publicly received the homage of the Silesians, returned in triumph to Berlin, about the end of the year 1741. Early in the following year, he again joined his army; gained the hard contested battle of Czaslau over the Austrian General Prince Charles of Lorraine; seized the favourable moment for securing the territory which he had conquered, by negociating a separate peace with the Queen of Hungary; and resumed, amidst the acclamations of his citizens at Berlin, the internal administration of his kingdom. With a small retinue, and with his usual rapidity, he went through a great part of his dominions, enquiring into grievances, inspecting his revenues, and ascertaining the condition of his troops. But, in the midst of apparent peace, and while externally occupied in the institution of a new academy in his capital, and the celebration of his sister's marriage with the Prince Royal of Sweden, he was making the most active military preparations; and, under pretence of preserving the Germanic constitution from the encroachments of the House of Austria, he issued the most artful manifestoes, and at the head of 80,000 men suddenly entered the kingdom of Bohemia. He took the city of Prague, and was pushing his conquests with more than ordinary vigour; but, by the able and rapid exertions of Prince Charles of Lorraine, a stop was put to his progress, and he was compelled, with immense loss, to make a precipitate retreat into Silesia. He was so extremely mortified by the disastrous result of this campaign, that he is said to have forbidden all conversation on the subject at his court; and hastening to retrieve his lost honours with an army of 70,000, he came upon the Austrians unexpectedly at Hohen Freidberg, where he gained a complete victory, as much by his own crafty generalship, as by the valour of his soldiers. Marching forwards into Bohemia, he was suddenly met and attacked in his camp at Sohr, by his enterprising adversary the Prince of Lorraine; but though thus taken at great disadvantage, and assailed by superior numbers, he took his measures with so much promptitude and skill, and received such able support from his officers and men, that, besides repulsing the attack with spirit, he routed the enemy with great slaughter. Sending his army into winter quarters, he entered Berlin in

tion into Hungary, and acquired a zealous ally by
[illegible] ion of Peter III. to the Russian empire, he
[illegible] d to gain ground upon his enemies, and to
[illegible] with invasion in their turn. Though
[illegible] d of his Russian auxiliaries by a new
[illegible] ersburgh, he availed himself so ex-
[illegible] esence, that he entirely recovered
from [illegible] red the frontiers of Bohemia,
with [illegible] erg and Nuremburg, and
affability [illegible] of Ratisbon. Favoured
making the [illegible] which disposed the
minations, he [illegible] to open proposals of
well of one of his [illegible] tions for a gene-
the point of death. [illegible] Hubertsbourg

In the year 1746, a [illegible] seven years
the powers of Germany, [illegible] projects
pied with matters of [illegible] suf-
rious regulations for the [illegible]
ture and the arts. He directed [illegible]
larly to effect a thorough reform [illegible]
tice, especially to lessen the delays [illegible]
legal proceedings; and at length produced [illegible]
FREDERICIAN CODE, which was adopted [illegible]
sian dominions.* In concurrence with the [illegible]
Maupertuis, he framed, about the same time, [illegible] additional rules for the Royal Academy; but he [illegible]ed his philosophers rather like a regiment of soldiers, and attempted too much to regulate matters of taste and opinion by kingly authority. During the same period of peace, he published his "Memoirs of the House of Brandenburg," and his "Poem on the Art of War;" the former, a work written with spirit, and full of valuable information, though not always free from mistakes and misrepresentations; and the latter, a performance neither destitute of poetical merit, nor deficient in sound principles of military science, but remarkable for the extraordinary omission of the name of Marlborough, while the generals whom the British commander frequently defeated are furnished with their respective portions of fame. He employed himself much in embellishing some of his principal cities; and among other measures, which he adopted for the benefit of his subjects, he asserted their right to navigate the seas without interruption from belligerent powers, so that he has been considered as the author of the system of armed maritime neutrality. He exerted himself by every method to increase the population of his dominions; and, in this view, expended large sums of money in clearing waste lands and forming navigable canals; gave great encouragement to French Protestants and other industrious emigrants to settle in his territories; and particularly succeeded by these means in peopling and fertilizing the deserts of Pomerania.

In 1749, he was visited by the celebrated Marechal Saxe, whom he treated with every mark of distinction; and in the year following, after various applications, he prevailed upon Voltaire to reside at his court, whom he created one of his chamberlains, and provided with an annual pension of 20,000 livres. But their friendship was not of long duration; and they were both too ambitious of despotic power in the republic of letters to exist harmoniously in the same circle. The king was disgusted by the familiarity with which the French wit behaved to him in public, and with the sarcastic remarks in which he sometimes indulged even upon his royal person. His majesty also was much offended by a money transaction of rather a dishonourable description, in which Voltaire had engaged with the aid of a Jew; and the other wits at the Prussian court, envious of his high favour, took care to report to the monarch's ear the most offensive of his sayings. But the principal cause of their greatest misunderstanding and final separation, was the decided part which Voltaire took against Frederick in a dispute between Maupertuis and Koenig. Even this open dissension was in some measure composed, when his majesty having sent a message to Voltaire, requesting him to write an apology to Maupertuis, the Frenchman burst into a violent rage, and desired the messenger to tell the king that "he might go to hell." Still, it is said, they had another interview, in which they were seemingly reconciled, and Voltaire received permission to go to Plombieres for the benefit of his health; but the king having afterwards discovered, that Voltaire had written a satirical piece against him, he sent a letter dismissing him from his service, and requiring him to return the contract of their engagement, with a volume of poetry, with which he had been entrusted. Voltaire immediately left Berlin, but retained possession of the contract, which bound Frederick to pay him 20,000 livres a year, and of the poetry, which he considered as a present; but he was arrested at Franckfort on the Maine at the king's instance, and treated in a most unworthy manner, till he made the required restitution.

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* This work was first published in the German language, and afterwards in French. An English translation was printed at Edinburgh, in 1761, in two volumes 8vo.

In 1753, Frederick exerted all his influence to prevent the election of a king of the Romans, which was considered as a measure highly conducive to the peace of Germany; but which, as tending to aggrandise the house of Austria, he was anxious to obstruct; and, by his persevering opposition, prevented its execution for many years. In 1756, he concluded a treaty with his Britannic Majesty, in which they mutually stipulated for the defence of their common country, to prevent all foreign troops from entering on any pretence into Germany. But the great army which Frederick maintained, his indefatigable diligence in exercising his troops, and his well known enterprising spirit of ambition, having long excited a general apprehension among the neighbouring powers, an extensive confederacy, or partition treaty, was at length concluded, between Russia, Austria, Poland, the Elector of Saxony, and the court of Versailles, to restrain his projects and retrench his power. Dissatisfied with the explanations which he had demanded of Austria, respecting her military preparations, and which the Empress had assured him were entirely defensive, he resolved to commence hostilities without delay, and precipitately involved himself in a long and hazardous war, in the course of which he acquired, indeed, a high degree of military fame, but reduced his kingdom to the eve of destruction. In 1756, he published his declaration of war against the Empress of Germany; entered the Electorate of Saxony with an immense army; seized upon its revenues, magazines and archives, and proceeded to administer its offices of government, by persons of his own appointment, as if it had already been incorporated with his own dominions. By his active and skilful manœuvres, he forced the Saxon army to surrender, after defeating the Austrians under Marechal Brown, who had advanced to its relief; but he tarnished the glory of his victory, by cruelly compelling the Saxon troops to enter into his service, and to fight against their own sovereign. His ambitious and unjustifiable measures called forth the strongest declarations from the principal governments of Europe; and, as Elector of Brandenburg, he was, by a decree of the Aulic council, put under the ban of the empire. He opened the campaign of 1757, with an army of 200,000 men; and, though the Russian, French, and Austrian forces, united against him, amounted to more than three times that number, he poured his soldiers into Bohemia, before the Austrians were aware of his approach; and, joining his columns with extraordinary rapidity, unexpectedly attacked, and completely defeated the enemy at Prague. By a strict blockade, and destructive bombardment, he reduced the city to the utmost extremities; and, by the joint effect of his calculating cruelty and military skill, was on the point of compelling 50,000 Austrians, within its walls, to surrender, when his good fortune sustained a fatal reverse, and his own impetuous confidence subjected him to a defeat. Attempting with an inferior force to dislodge Marechal Daun, who had advanced to Collin for the relief of Prague, he was routed with dreadful slaughter, and obliged to retreat with all his troops towards Saxony. His favourite brother, William Augustus, a prince of great abilities, and singularly amiable character, devotedly attached to his person, who had repeatedly distinguished himself in his service, having suffered some loss in bringing off the division with which he was entrusted, and having ventured to remonstrate with Frederick upon the calamities of the war, was dismissed with the most humiliating reproaches, and driven, by the harshness of his treatment, to a state of the deepest melancholy, which terminated his life in the course of the following year.

The difficulties of the Prussian Monarch now began to multiply with fearful accumulation. The loss of some of his ablest generals, the junction of the Swedes with his enemies, the capture of Memel by the Russians, the successes of the French against the Electorate of Hanover, the progress of the Austrians in Silesia, and their entrance into Berlin, where they levied a contribution on the inhabitants, reduced his affairs to a situation of the most critical nature, and drove him at one time to form a design of committing suicide. He communicated his intention to his most intimate confidant the Marquis D'Argens, in what he called his farewell letter; but received from his friend an immediate reply, so expressive of affection, and convincing by its reasonings, that he was roused from despair, and animated to farther efforts. Collecting his troops, he attacked the French at Rosbach; and, with very little loss on his side, gained a splendid victory over an army, which was double the number of his own. Hastening by forced marches into Silesia, where his troops were hard pressed by the Austrians, he gave battle to the enemy at Leuthen, and, by a disposition of his line, coinciding with that which was made by Epaminondas at Leuctra, gained a most signal victory, which put 40,000 prisoners into his hands, and gave him complete possession of Silesia. The resolute resistance which he maintained against his numerous enemies, the rapidity with which he recovered his losses, the greatness of his enterprizes, the splendour of his victories, the military skill, mental fortitude, and personal courage, which he had displayed in the whole of this memorable and eventful campaign, attracted the attention of surrounding nations, and gained him the applause even of his opponents. Aided by a large subsidy from Great Britain, where the fame of his exploits had acquired him extraordinary popularity, he opened the campaign of 1758 with the happiest prospects. Entering Moravia, he attempted, without success, to reduce the city of Olmutz; and hastening to the Oder, where the Russians were committing the greatest ravages, he routed them with great slaughter at Zorndorf. Having returned to the Elbe, he sustained a severe repulse from Marechal Daun at Hochkirchen in Lusatia, where he lost Marshal Keith, and was himself slightly wounded, but afterwards succeeded in forcing the enemy to retire from Saxony; and in one campaign twice made the circuit of his dominions, relieving them all in their turns from their formidable invaders.

In 1759, his operations were so extremely unsuccessful, that, had his enemies known as well how to improve as to obtain victories, he must have been utterly undone. After watching, for some time, the motions of Marechal Daun, he hastened in person to oppose the Russians on the Oder, and engaged them at Kunersdorf, at first with great advantage; but having, contrary to the advice of all his generals, attempted to crush their reserve with his exhausted troops, he suffered the severest of his defeats, after having two horses killed under him, and his clothes penetrated in several places with musket balls. Never, however, did the resources of his genius, and the fortitude of his spirit, appear more remarkably, than after this adverse stroke; and, aided by the dissensions which prevailed between the Russians and Austrians, he covered his capital, and kept his powerful opponents at bay during the winter. After several unsuccessful overtures respecting peace, in which he shewed no inclination to cede an inch of his territories, and in which he was no farther sincere, except in hoping to detach one or more from the confederacy, he renewed the unequal contest with his usual spirit and perseverance. In 1760, he had occasion for all his ingenuity, and was obliged to employ his tactics more than his firelocks. Nearly surrounded by three armies, each superior in number to his own, he baffled all their plans of attack, by incessantly changing his positions; and succeeded at length in extricating himself from his difficulties, by surprising and defeating Laudohn at Psaffendorf, while Daun was expecting to overwhelm him at Lignitz. He removed the Russians out of his way, by causing a letter with false intelligence to fall into the hands of their commander; and thus opened his communications with Breslaw; but was unable to prevent a body of Austrians and Russians from occupying Berlin, and pillaging his palaces. Still threatened by hostile masses in every quarter, and perceiving his only safety to lie in preventing their junction, he determined to commit his cause to the fate of a battle; and, after a desperate and sanguinary conflict with Daun at Torgau, he gained a victory which removed the most formidable and most immediate of his dangers. Unable, however, though sufficiently lavish of blood, to bear the loss which even victories required, he resolved, in the campaign of 1761, to act solely on the defensive; but, at the same time, by often threatening an attack, to conceal the purpose which he had adopted. He therefore entrenched his army in a camp of singular strength near Bunzelwitz, in Silesia, on which he set at defiance the numerous divisions of the enemy, by which he was threatened on every side. Obliged by want of provisions to change his fortified posts, he often contrived, by distributing ammunition and preparing his arms, to impress his opponents with the persuasion, that he designed some daring assault; and on one occasion he actually kept a superior force of Russians and Austrians in such a state of alarm, that they slept eight nights on their arms, in the expectation every moment of being roused by his approach. In 1762, though the assistance of Great Britain was withdrawn, yet, having engaged the Tartars to make an irruption into Hungary, and acquired a zealous ally by the accession of Peter III. to the Russian empire, he was enabled to gain ground upon his enemies, and to threaten them with invasion in their turn. Though speedily deprived of his Russian auxiliaries by a new revolution at St Petersburgh, he availed himself so expeditiously of their presence, that he entirely recovered Silesia and Saxony, ravaged the frontiers of Bohemia, sent detachments to Bamberg and Nuremburg, and spread terror to the very gates of Ratisbon. Favoured by a variety of circumstances, which disposed the courts of Vienna and Versailles to open proposals of peace, he readily entered into negociations for a general pacification, which was concluded at Hubertsbourg on February 15, 1763; and thus, after a seven years sanguinary struggle, to which his unprincipled projects had given rise, and in which, independent of other sufferers, more than half a million of combatants had fallen in the field, every thing was replaced on its ancient footing, and the only gainful result was simply this, that Frederick of Prussia had been furnished with an opportunity of proving himself a consummate commander, animated by an unconquerable spirit of military heroism, and endued with one of the coolest heads and hardest hearts in Christendom.

Returning to his capital, after an absence of nearly six years, Frederick applied himself, with all his talents and perseverance, to the internal improvement of his kingdom; rebuilt the towns and villages, and remunerated the individuals who had suffered during the war; and afforded every encouragement to agriculture, manufactures, and commerce. But he always regarded the army as the principal object of his attention; and in a very short time after the peace of Hubertsbourg, his regular force amounted to 200,000 men. Little scrupulous in the means by which he accomplished his schemes, he defrayed much of his expenditure by issuing base money, which he compelled his subjects to take in payment; but which he ordered his commissioners to refuse in collecting the taxes. For the purpose of peopling his own territories, he carried from the neighbouring provinces of Poland many thousand families; and, in order to round his dominions, he was the prime mover and most active perpetrator of the infamous partition of that country in the year 1777. He was not disposed, however, to tolerate similar acts of robbery, in which he had no share; and, when the Emperor Joseph took possession of Bavaria, he resisted his unjust pretensions, and conducted in person the campaign, or rather armed negotiation of 1778, which was terminated by the peace of Teschen. The two last of his public acts were the establishment, in 1785, of the Germanic union for preserving the constitution of the empire; and a treaty of amity and commerce, in 1786, with the United States of America.

Frederick was now seventy-four years of age, in full possession of all his mental powers, but extremely debilitated in his corporeal frame. He began to suffer much from dropsy, without being sensible, (or at least without being willing to allow,) that he was afflicted with that disorder. He nevertheless continued his attention to public business, without the smallest interruption. Rising at four o'clock every morning, he employed himself several hours with his three principal secretaries, reading dispatches, dictating answers, and directing the most minute transactions of his government. The governor of Potsdam then attended about eight o'clock to receive his orders respecting the daily duty of the garrison. He next admitted a physician for a few minutes to give direction respecting his health. He then conversed with his friends until mid-day, when he generally dined alone. In the afternoon he signed the dispatches and letters, which he had dictated in the morning. He joined his friends again in conversation from five to eight o'clock in the evening; and, after their departure, listened to passages from ancient authors till he retired to rest. In this course of labour he persevered till two days before his death; although for several weeks preceding, he was so swollen with the dropsy, that he could not move without assistance, and was obliged to remain day and night in his chair. Though he suffered dreadfully, he betrayed no symptom of uneasiness or impatience; but conversed with great composure on general subjects, and without ever alluding to his own state of health. On the 16th of August he was deprived of sense, while his friends were reading to him from Cicero and Plutarch; and on the morning of the 17th, he expired without any convulsive motion, in the 75th year of his age, and the 47th of his reign.

Frederick, in his person, was below the middle stature, and of a slight form, but possessed of a vigorous constitution. In his earlier years his figure was graceful; but in the latter part of his life, in consequence of incessant fatigue, or as some suppose of his incessant custom of making extremely low bows, he stooped considerably, and his head was inclined to one side. He was short-sighted, and his eyes were of a fine blue colour, but full of fire, and expressive of uncommon keenness and penetration. His tone of voice was extremely clear and agreeable; and he spoke with the utmost fluency and sprightliness. He was, especially in the latter part of his life, a great economist, or rather uncommonly shabby in his dress, which was usually a plain suit of regimentals, consisting of a blue coat faced with red, and yellow waistcoat and breeches. He always wore boots, which being rarely renewed, were generally of a dirty brown colour. His hair was simply queued, and he had no other mark of distinction than the order of the black eagle. His whole wardrobe, says Dr Moore, to whom it was shewn at Potsdam, consisted of two blue coats faced with red, the lining of one a little torn; two yellow waistcoats a good deal soiled with Spanish snuff; three pair of yellow breeches, and a suit of blue velvet, embroidered with silver for grand occasions. I imagined at first, that the man had got a few of the king's old clothes, and kept them here to amuse strangers; but upon enquiry I was assured, that what I have mentioned, with two suits of uniform which he has at Sans Souci, forms the entire wardrobe of the King of Prussia. Our attendant said he had never known it more complete. When residing at Berlin, and particularly on public days, he made a great display of royal magnificence; but his ordinary mode of living was remarkably plain and uniform. His usual place of residence was the palace at Sans Souci, about a mile from Potsdam. His bed-chamber was beautifully furnished and provided with the appearance of a rich state-bed; but he always slept in a concealed bedstead, upon a hard mattress. He rose generally at five o'clock in the morning, and sometimes earlier. He dressed his hair himself, seldom employing above two minutes for that purpose; and pulled on his boots at his bed-side, never using either shoes or slippers. As soon as he was dressed, the adjutant of his first battalion of guards brought him a list of all the persons who had arrived at Potsdam or departed thence, with an account of any occurrences in the garrison. Having delivered his orders to this officer, he retired to an inner cabinet till seven o'clock. He then went into another apartment, where he drank coffee or chocolate, and perused his letters; and these, as he seldom received the most trifling proposal or petition except in writing, were always numerous. Having written notes on the margins of those which his secretaries were to answer, he carried with him such as he meant to answer himself, and continued with one of his private secretaries writing or dictating till nine o'clock, when he returned to the former apartment, where he was attended by three secretaries, and received their communications, or delivered to them his orders. At ten o'clock, the generals in attendance were admitted to his closet, where he conversed with them, or gave private audiences. At eleven he rose to the parade, where he reviewed his regiment of guards, and at the same hour all his colonels throughout the provinces were employed in the same manner. He then walked in the garden with the principal officers, and the rest of the company who were invited to dinner. At one, he sat down to table, seldom with more than twenty-four persons, and seldom occupying more than an hour. After rising from table, and conversing about a quarter of an hour with his guests, he retired to his private apartment, where he remained till five o'clock, when his reader waited upon him, who was generally one of his friends; and after reading about two hours, he joined in a musical concert till nine. He was then attended by a few of his learned friends, and favourite wits, whom he had invited to supper, and with whom he indulged in the utmost freedom of conversation till twelve, when he went to bed. Afterwards he omitted these suppers, and spent a longer time at dinner, where he used to eat with good appetite, and was particularly nice in regard to fruit. He was not less fond of Spanish snuff, of which he was accustomed to take immoderate quantities; and used a large golden snuff-box, richly ornamented with diamonds. He was much attached to dogs, and had generally beside him two or three Italian greyhounds, which he often caressed, and even kept small leather balls in his rooms in order to amuse them. He took little pleasure in the company of ladies, and rarely invited them to his private parties. His great and daily amusement consisted in musical concerts, at which he performed on the flute; but he confined himself chiefly to his own compositions, and those of his instructor Quantz; and even endeavoured, with his usual despotism, to regulate the musical taste of his subjects by authority.

His literary acquisitions, when compared with the disadvantages of his education, were considerable; but were, in a great measure, confined to the *belles lettres*, and to moral science. He possessed little knowledge of the Greek and Latin languages; and his acquaintance with classical authors was derived principally through the medium of French translations. Besides the works which have been already mentioned, he wrote letters on patriotism and on German literature; and left behind him in manuscript, *Memoirs of his own Time, from the Year* 1740 *to the Peace of Dresden—A History of the War of Seven Years*—and, *A History of the Transactions from the Peace of Hubersburgh*; which were published after his death. His poetical compositions, consisting of his poem on the art of war, with a variety of odes and epistles, are collected under the title of *Oeuvres melées du Philosophe de Sans Souci*. He displayed, in his capacity of a ruler, more of personal ability than of political wisdom. He was constantly aiming at the aggrandisement of his dominions, which he never hesitated to accomplish by the most unprovoked hostilities and unprincipled usurpations. He devoted, indeed, the last twenty years of his life to promote the prosperity of his subjects; but always upon principles of despotism, and in subserviency to ambitious schemes. In attention to his army, his government, and the internal policy of his kingdom, he was probably the most indefatigable sovereign that ever existed. His vigilance was unremitting, his industry unwearied. Every department of government was under his own immediate inspection; and the most minute particulars did not escape his observation. He conceived himself capable of every thing, and despised the talents of others. His numerous nominal counsellors he never consulted; and to his various ministers of state he delegated no portion of superintending power; but he would direct and almost perform every thing himself. This intermeddling and controuling spirit was the great error of his administration; and rendered many of his financial and commercial plans more pernicious than profitable to his people. He interfered even in judicial proceedings and literary questions; and made himself the supreme reviewing tribunal in all matters of equity and taste. He introduced a kind of military mechanism into every department; and "was constantly working mischief by working too much." It was at the head of an army, that his talents appeared to the greatest advantage; and he must be acknowledged to have been the most accomplished warrior of modern times. He possessed an extensive knowledge of military science; and is ranked next to Maurice, Prince of Orange, and Gustavus Adolphus, as an inventor in the modern art of war. He introduced the use of flying artillery, and improved the oblique or angular order of battle, of which he profoundly studied the principles, and skilfully illustrated the efficacy, in not less than forty-two engagements. He was eminently distinguished by the promptitude and energy with which he executed his plans; and was always sure to prevail wherever active exertion could ensure success. His personal intrepidity, his astonishing presence of mind in the moment of danger, and his patient endurance of hardships and privations, could not be surpassed; and in all his severest reverses, he discovered a mind that could not be subdued. Yet, with all his great endowments, there was little in his character to make him either amiable as a man, or venerable as a sovereign. Many of his faults may, no doubt, be traced to the despotic sentiments in which he was educated, and the military habits in which he lived; but there are traits in his character, which incontestably demonstrate, that his superior powers of intellect were united with a radical littleness of mind. His parsimony, ingratitude, cruelty, and injustice, are proved by a thousand instances. He examined every evening the bill of fare for next day's dinner, squabbling with his domestics about the prices of every article, and paying with his own hands the expences of his kitchen, stables, &c. He never bestowed one smile of favour upon the relatives of his friend De Catt, who had sacrificed himself in his behalf. To the family of the Wrechs, who had befriended him in his imprisonment at the risk of their lives, he neither repaid the sums which they had pinched themselves to raise for his accommodation, nor distinguished them by any act of patronage. He broke the heart of his amiable brother, William Augustus, by harsh usage; and ruined the health and happiness of his youngest sister Amelia, by his barbarous persecution of her lover Trenck. He lavished, with unfeeling prodigality, the blood of his soldiers; and dismissed in time of peace his bravest officers, because they were not of noble extraction; though he had invited them to enter the army when he needed their services. He uniformly quarrelled with his most intimate associates; and often discarded, with the harshest injustice, those who had most faithfully spent their lives in his service. He commanded his favourite Secretary Galser to coin fifteen millions of ducats with an alloy of one-third of base metal; and, when the matter was discovered, he punished the unfortunate secretary with disgrace and banishment, as the author of the fraud.

He treated his literary companions and dependants with insolent familiarity, making them the butts of his sarcastic raillery; and, after encouraging them to similar freedoms, suddenly silencing them with his kingly authority, or with the most passionate abuse, and sometimes even with kicks and blows. He delighted to indulge in the most impious discussions; and bestowed the highest marks of his favour upon the most atheistical blasphemers. His general spirit in short was selfish and unfeeling; and, though he wished for the praise of virtue, he was ready to sacrifice every consideration to the love of fame, especially to the attainment of military renown. His intellectual powers, however eminent, were at least of that inferior order, which can submit to be guided by profligacy of principle, and stoop to seek assistance from dishonourable means. His abilities thus often appeared much greater than they were in reality; because, when wisdom failed, he had recourse to wickedness, and accomplished objects which would have baffled others, not because they were weaker, but because they were better men. Such, in fact, is often the chief superiority possessed by those who have received the appellation of Great; a "title, which is the less honourable, that mankind have generally agreed to bestow it, where gratitude was least of all due." See Gillies' *View of the Reign of Frederick II. of Prussia*; Tower's *Memoirs of the Life and Reign of Frederick of Prussia*; Thiebault, *Memoires de Frederic le Grand*; Johnson's *Memoirs of the King of Prussia*; Baron Bielfeld's *Letters*; *Observations on the Military Establishment of the King of Prussia, with an Account of his private Life; the King of Prussia's Campaigns written by an Officer, and translated from the French*; *Anecdotes and Characteristics of Frederick the Great*; Riesbeck's *Travels in Germany*; Thomson's *Military Memoirs*; Voltaire's *Idée du Roi de Prusse*. (*q*)

FREE Masonry. See Mysteries.

FREEZING. See Cold.

FRESCO Painting. See Painting.

FRIBOURG, or Friburg, a town of Switzerland, and the capital of a canton of the same name, is situated partly on a horizontal plane on the banks of the Sarine or Saane, and partly on the declivity of a ridge of rugged rocks, which form a singular contrast with the walls of the town and the towers of its convents and churches. When a stranger ascends the street of the Great Fountain in coming from the *Bains des trois Suisses*, he can scarcely persuade himself that he is in the middle of a large town. The fortifications of Fribourg, consisting of lofty walls and towers, are about four miles in circumference, and inclose a large space, a great part of which is occupied with gardens and orchards. The descent to the town is on all sides extremely steep, and the street of the Great Fountain forms the roofs of the houses of the *Court-chemin*. A communication is made between the two parts of the town by three bridges, from which there are very picturesque views. The most advantageous stations, from which an idea may be formed of the extraordinary situation of Fribourg, are the top of Schonenberg; the meadow situated beyond the crucifix, which is seen in going out by the gate of Bourguillon; and the meadow which extends behind the *Place d'Armes*, near the gate of Romont.

The houses of Fribourg, which are raised above each other in regular gradation, are built with a grey sandstone from an adjacent quarry, and are in general neat and well built, though the town has a dull appearance. In the middle of the principal square, is the celebrated limetree, of great size and beauty, which is said to have been planted there in the 22d June 1476, by a soldier, on his return from the battle of Merat. For some years, this venerable tree has been losing its vigour. The townhouse is an ancient edifice, which was built on the spot where the palace of the Dukes of Zuhringul formerly stood. The cathedral church, dedicated to St Nicholas, was founded in 1283. Its tower is 356 feet high, being the highest in Switzerland. The bells are reckoned the finest in the country. The *ci-devant* college of the Jesuits, situated in the highest part of the town, affords, from its lofty towers, some of the finest and most extensive views. The other objects of interest at Fribourg are, the gate of Bourgillon, situated between two precipices; the principal altar of the church of the convent of Augustins; the great reservoirs situated near the college of Jesuits; the mill of Motta, opposite to the convent of Maigrange; and the defile of Gotteron. The cabinet of natural history belonging to M. Fontaine; the library, pictures, minerals, and philosophical instruments belonging to M. Joseph Praroman; the collection of books and MSS. relative to the history of Switzerland, belonging to M. Ignace Gady; and the small botanic garden of M. Odet, are worthy of the notice of travellers.

There is at Fribourg a seminary of priests; a gymnasium; schools for young persons in the convents of the Ursulines, and the Visitandines, and other inferior schools kept by the Franciscans and the Capuchins. There are 28 public fountains in Fribourg, of which the water is excellent. The inhabitants of the lower town, however, were formerly much afflicted with the goitre necks, but the disease is now less general.

The line of demarcation between the German and French languages passes through Fribourg. The inhabitants of the lower parts of the town speak German, and those in the higher part French, while the two languages are confounded in the middle of the town.

The principal manufactures of Fribourg are hats, candles, beer, earthenware, cotton cloths, &c. The chief promenades are in the square, planted with limes and in the Place d'Armes. Population 6,000. East Long. 6° 48′, and North Lat. 46° 50.

FRIBOURG, Canton of. See Switzerland.

FRICTION. See Mechanics.

FRIEDLAND, Battle of. See France, p. 648.

FRIENDLY Islands, are situated in the eastern part of the Pacific Ocean, and lie between 16½° and 21½° South Latitude, and between 176° 30′ and 185° 50′ East Longitude. Their name expresses the firm alliance subsisting among their inhabitants, and the courteous behaviour which they testify towards strangers. Their number exceeds 150, but the greater part are mere rocks and shoals, or barren and desert spots. Nearly one half, however, are of considerable size, but the situation and extent of a few only have been ascertained. Sixty-one are marked on Captain Cook's chart, and the principal information concerning them is to be found in his voyages.

Tonga. The most important are, Tonga, Tongatabeo, or Amsterdam, discovered by Tasman in 1642, is situated in 21° 9′ South Latitude, and 175° 1′ West Longitude. It is rather of an oblong form, bearing some resemblance to an isosceles triangle, stretching in length from east to west, broadest at the east end, and about 20 leagues in circumference. It is a low land, nearly all of an equal height, never rising more than 80 feet above the level of the sea; and is surrounded by a reef of coral rocks, extending about 100 fathoms from the shore, and breaking the force of the sea before it reaches the land. A deep lagoon on the north coast, forms a secure and capacious harbour with a good bottom, but there is great scarcity of good fresh water in all these islands. This kind of rock appears also to be the basis of the island, as scarcely any other stone is seen either on the coast or in the interior. The rock projects in many places above the surface, but the soil is generally of a considerable depth, and in the cultivated parts is a loose black mould, apparently produced by decayed vegetables. The surface at a distance appears to be clothed with trees of different sizes; but the tufted heads of the cocoa palms produce the most striking effect. The largest tree is a species of fig; and the most common bushes on the uncultivated spots, are the pandanus, saitaneo, and several sorts of hibiscus. Though the climate is more variable than in countries farther within the line of the tropic, yet the foliage is only shed by degrees, every leaf as it falls being succeeded by another; and though the country exhibits little of that landscape beauty, which is produced by a variety of hills and vallies, yet it is well laid out in plantations, and altogether presents the appearance of perpetual spring, and exuberant fertility. It abounds in the richest productions of nature; cocoa nut trees, bread fruit, plantains of fifteen varieties, bananoes, shaddocks, sugar-cane, a kind of plum, fig, and nectarine, yams white and black, the latter of which weigh from 20 to 30 pounds, gourds, Jesuits bark, bamboo, &c. and an innumerable list of uncultivated plants. The only quadrupeds are hogs, dogs, rats, and small lizards.* The land birds, besides large domestic fowls, are pigeons, turtle-doves, parrots, parroquets, cuckoos, king's fishers, rails, coots, fly-catchers, swallows; large bats, measuring from three to four feet between the tips of the wings when extended; a kind of green-coloured thrush, the only singing bird observed in the island; and several smaller birds. The water fowl are ducks, tropic-birds, herons, noddies, terns, small curlew, and large spotted plover. Nearly fifty different sorts of insects have been noticed, particularly very large spiders, and the most beautiful moths and butterflies; and of the reptile tribe, sea snakes about three feet long, scorpions, centipedes, and guanoes. The variety of fish is not so great as might be imagined; and the most common are mullets, silver fish, old wives, parrot fish, soles, leather jackets, albicores, bonnelos, eels, pike, and devil fish; but there is great abundance of shell fish about the reefs and shoals, especially huge cockles, pearl shell and some other oysters,

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* M. Dentrecasteaux was informed in 1793, that the horses and cows left by Captain Cook were all dead; but found that the hogs had been greatly improved by the cross with those of Europe, some of them weighing not less than 300 pounds.

(but none of the common sort,) cones, crabs, cray fish; sea eggs, curious kinds of star fish. There are no towns or villages on the island, and the houses are built in the midst of separate plantations. These plantations are inclosed by fences of reeds about six feet high, and these inclosares called Abbeys, frequently contain four or five houses. Smaller spaces round each habitation, are called Ladores.

Eoa.

Eooa, named by Tasman Middleburgh, lies to the south-east of Tongataboo, in 21° 24′ South Latitude, and 174° 30′ West Longitude. It is of an oval form, about 12 leagues in circuit, of greater height than any of the neighbouring islands, and presents a more varied and delightful aspect. The coasts are shaded with a variety of trees, among which the houses and plantations are scattered; but the interior parts are little cultivated, and possess a high degree of natural beauty. The south-east side rises immediately from the sea with great inequalities, and is rather hilly, though not mountainous. The plains and meadows lie towards the north-west, and are covered with long grass, interspersed with groves of trees at irregular distances, with occasional plantations and numerous paths, in every direction, and in beautiful disorder. This island, like Tongataboo, and indeed most of the tropical isles in the Pacific Ocean, is surrounded with coral rocks; but there is good anchorage, called by Cook, English Road, on the north-west side, with convenient landing for boats at all times of the tide.

Annamooka.

Annamooka, named Rotterdam by Tasman, lies in 20° 46′ South Latitude, and 185° 12′ East Longitude. It is a small triangular island, each side of which is nearly four miles in length, and is the most known of a cluster called Arbai. All the rocks and stones are coral except in one place, where a large mass of calcareous stone, of a yellowish colour, was observed. In the centre of the island, is a salt water lake about a mile and a half in breadth, which has no apparent communication with the sea; but there is not a single stream of fresh water to be found in any part of it, and only a few brackish springs too small for watering a ship. There is a considerable proportion of waste land on the island; and its inhabitants are much affected with a kind of leprosy, or scrofulous disorder, which chiefly attacks the face; but in its productions, and in other respects, it greatly resembles Tongataboo.

apaee
lands.

Hapaee islands, namely Haanno, Foa, Lefooga, and Hoolawa, lie in 19° South Latitude. They are very low land, extremely similar to each other in appearance, and each of them about six or seven miles in length. Lefooga, which lies in the centre, is superior in point of cultivation to Annamooka, and many of its plantations are inclosed in such a manner, that the fences running parallel to each other form spacious public roads. These islands are joined to each other by a reef of coral rocks, which are dry at low water, when the natives can walk on foot from the one to the other.

yorga.

Mayorga, a group of islands about 100 miles north-west of Hapae, were discovered in 1781 by the Spanish navigator Maurelle; and were visited by Captain Edwards in 1791, who named them Howe's islands. The largest is nearly as extensive as Tongataboo, fertile and well cultivated, affording all the vegetable productions of these latitudes, and particularly stored with the cloth plant.

Neootaboo-taboo.

Neootabootaboo, and Kootahé, situated in South Latitude 15° 55′, and 173° 48′ West Longitude, were discovered by Schouten and Lemaire in 1616. The former is one of the larger islands in these seas, fertile and populous. They were visited by Captain Wallis in 1767, who called them Keppel's and Boscawen's islands; and in 1787 by Perouse, with whom the natives traded very freely, but had a more ferecious appearance than the more southern islanders.

Toofoa.

Toofoa, or Amattafoa, is situated about 12 leagues north north-west from Annamooka, and is about five leagues in circumference. It is thinly inhabited, but was reported to afford excellent water. It is chiefly remarkable as containing a volcano, the smoke of which was seen by Captain Cook at ten leagues distance; and which was described by the natives of the adjoining islands, as having been observed to ascend without intermission as far back as their memory and traditions could reach. They added, that it sometimes threw up large stones. It was at this island that Captain Bligh, after the mutiny of his crew, attempting with 18 of his people to procure a supply of bread, fruit, and water, was attacked by the natives, who killed one man, and wounded almost every individual of his company.

Hamoa, Vavaoo, Feejee.

Three very considerable islands, or rather groups, were described to Captain Cook, larger than any yet mentioned, but they are still very imperfectly known to Europeans. Their names are Hamoa, Vavaoo, and Feejee. Hamao, which is two days sail north-west from Vavaoo, is said to be the largest of all the islands, affording safe harbours, good water, and all the refreshments produced in the other places. Vavaoo, or Afootouou, is the name not of one but of a group of islands, of which little is known, except that they are abundantly stored with hogs. Feejee, which is three days sail from Tongataboo, in the direction of north-west by west, and which is surrounded by a cluster of islands, abounds in hogs, dogs, fowls, and all the fruits and other vegetables found in these islands. Its breed of dogs are very numerous, and from them had been procured the few which were seen at Tongataboo, where they were not introduced till after 1773, and from which they had not been sent to any of the other islands in 1777. The natives of Feejee * are of a darker colour than those of the other Friendly islands; more formidable in war, by their dexterity in the use of bows and slings; more savage in their manners, especially in the practice of eating the enemies whom they kill in battle; and more ingenious in their articles of workmanship, of which Captain Cook saw several specimens; such as variegated mats, earthen pots, beautifully chequered cloth, and clubs and spears covered with great ingenuity. These islands of Feejee appear to be the same which Tasman named Prince William's Isles, and were explored both by Captain Bligh in the Providence 1792, and by Captain Wilson in the Duff 1796. They reach northward as far as 15° 33′ of Latitude, and south to 19° 15′, and lie in 178° West Longitude. Captain Barber in the Snow Arthur, visited the western part of the group in 1794, and was attacked by a number of the natives in canoes, who attempted to board the ship, and wounded several of the crew with their arrows.

Government.

All these islands which have been described, and all those which form the archipelago named Friendly, are under the government of one king, excepting Feejee,

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* The most recent account of the Feejee islanders, is furnished by an extract from the Sydney Gazette, published in the Scotch Magazine for 1810, page 601.

Government.

which is supposed to have become but recently known to the others, and whose warlike inhabitants, scarcely yet subdued, are greatly dreaded, and their friendship carefully cultivated by the other islanders. The capital and seat of government is Tongataboo; but the king resides occasionally on the other islands, particularly Hamao, the inhabitants of which appeared to be held in great estimation. The king was said to possess unbounded authority, and to have the absolute disposal of the lives and property of his subjects; but there appeared rather to be a kind of subordination, similar to the feudal system which formerly prevailed in Europe, as the more potent chiefs acted the part of petty sovereigns among their respective followers, and frequently counteracted the measures of the monarch. Tongataboo is divided into numerous districts, each of which has its proper chief, who dispenses justice, and decides disputes within his own territory, and who generally possess estates in the other islands, from which they receive supplies of provisions. This island is called by the natives the Land of Chiefs, while the subordinate isles are stigmatized with the appellation of Lands of Servants. Its ordinary name also Tongataboo, signifies the Sacred Isle, because it is the residence of the Duatonga, the head of a family, supposed to have come originally from the sky,* and who seems to hold the station of high priest. The king bears the title of Tooe Tonga, according to Cook; but according to later narratives, Duganaboota. The utmost order and decorum are observed in his presence, and in that of the other chiefs. Whenever he sits down, all the attendants seat themselves before him in the form of a semicircle, leaving a sufficient space between them and him, into which no one, unless he has particular business, presumes to come. When any person wishes to address his majesty, he comes forward, and seats himself before him, delivering in a few words what he has to say. In direct opposition to European manners, it is accounted the greatest rudeness for any one to stand while he speaks to a superior; and even when the king is walking along, all who meet him must sit down till he has passed. When it is intended to do homage more directly, either to the sovereign or the chiefs, the person who pays the obedience squats down before the superior, bows his head to the sole of the prince's foot, which he touches with the under and upper side of the fingers of each hand, and then rising up retires. The crown is hereditary; but it was mentioned to Captain Cook by the reigning king, that if he were to fail in his duties, the collective body of the chiefs and the people would authorise the commander of the forces to depose him, and put him to death. This very prince dying before his son was of age, the sovereignty was wrested out of his family by a powerful chief, after it had continued about 140 years in one line.

The king seems to be considered as lord of the soil, and upon him devolves the landed property of every subject at his death; but it is customary for the sovereign to grant the estate to the eldest son of the deceased, upon condition of providing for the other children. The different classes of the chiefs are very numerous; but few of them possess extensive districts of territory. They are called by the people, "the lords of the earth," and exercise a despotic authority over their respective vassals. The most profound silence and respectful attention are observed, when any of them addresses a body of their dependants; and no symptoms of dissatisfaction or disobedience were ever perceived among the latter. Every thing in their possession is considered as belonging to the chief, who takes from them without ceremony whatever he may need. However scanty their supply of provisions, they are required to cook a portion of it for his use; and, in a time of scarcity, he often sends his attendants round the district, with orders for a certain quantity to be prepared in a limited time, which he stores up for himself and his household, while the wretched people are reduced to subsist on the coarsest roots, or to beg back a little of their own fruits, to keep them from starving. Nor do the lower classes merely labour for themselves and their respective chiefs, but they are frequently sent, as a species of tax or tribute from their lords, to work on the lands of the sovereign; and, in addition to all these arbitrary exactions, they are treated by their superiors with the utmost harshness and brutality.

Religion.

The inhabitants of the Friendly islands acknowledge a supreme divinity residing in the heavens, and directing the elements; but they worship at the same time a plurality of deities, each of whom has a peculiar administration, one presiding over the wind, another over the sea, another over the rain, &c. They ascribe earthquakes to the motions of a giant, who supports their island on his shoulders; and, as they imagine the shaking to be occasioned by his becoming drowsy, they hasten to shout as loudly as possible, and to beat the ground with sticks, in order to rouze him, lest by his stumbling through sleep, he should throw the island from his shoulders. Each district also worships its appropriate god; and even every individual is supposed to have a particular spirit attending him, who sends afflictions and maladies when he is displeased, and, when irreconcileable, occasions death itself. To render him propitious, the relations or dependents of the patient frequently wound themselves, or cut off their little finger, and sometimes even some of his wives, children, or domestics, are put to death. They consider the power of their deities as confined to the present life, and their evil deeds as meeting always with punishment upon earth. Hence they employ every method to render them propitious, applying to them for a continuance of plenty, and supplicating their aid in time of suffering. They solemnly implore the blessing of the supreme divinity when they plant their crops, and express their gratitude when they gather them. Hence there is an annual assembly of the chiefs of Tongataboo, and of all the neighbouring islands, at the dwelling of Duatonga, the high priest, to offer the first fruits of their fields to him, as the minister and representative of the god who causes fertility. They do not appear to worship any visible part of creation, or any idols formed by their own hands; nor do they offer any animal victims, although on certain occasions they sacrifice human beings.

They have no priests, but every man presents his own offering. They discover a wonderfully just idea of the immortality of the soul, and in some degree also of its immaterial nature. They believe, that, immediately after the death of the body, the souls of the chiefs are swiftly conveyed to a distant island, where they are no longer subject to death, where every kind of food is spontaneously produced, and where they enjoy perpetual peace and abundance, under the protection of the supreme divinity. The lower classes, however, are supposed to have no share in this future bliss, and seldom speculate on the subject; but their souls are considered as either eaten up by a bird which watches their graves for that purpose, or as doomed to suffer a kind of transmigration into other bodies. Among these superstitious practices, may be mentioned the "taboo," although it may probably be nothing more than a political regulation. The word is used with great latitude of meaning, but seems to signify "prohibited," or set apart from common use. A house becomes tabooed by the king's presence, and can no longer be inhabited by the owner; and hence there are generally houses provided in every quarter for the use of his majesty. A space of ground may be tabooed, and all persons are then interdicted from passing over it. Any article of food may be tabooed by the officer who has the proper authority, so as to be withdrawn from use for a given time. By assisting at a funeral, or touching a dead body, the hands are tabooed, and cannot be employed in taking food; so that the person thus circumstanced is fed by others. Women are in this state on certain occasions, till they can have an opportunity of paying obeisance to the king; and even the act of paying obeisance occasions the hands to become tabooed, till they are washed in water, or by rubbing on them some juicy plant. The word also signifies sacred, or eminent, and is applied to the king of the Sandwich islands, who is called Eree-taboo, and to the residence of the king of the Friendly Islands, Tonga-taboo.

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* The missionaries were in like manner called by the natives of Tongataboo, "The men of the sky;" because observing that the sky appeared to touch the ocean in the distant horizon, and knowing that they came from a great distance, they concluded that they must have come through the sky to arrive at their island.

Agriculture.

As cultivated roots and fruits form the chief subsistence of these islanders, they are all employed in husbandry, in which they have attained a considerable degree of skill. Their plantations are generally surrounded with neat fences, and divided into separate plots, some of which are planted for ornament, but are chiefly occupied in raising articles of food. The principal of these are the bread-fruit and cocoa-nut trees, which are dispersed without any order, and soon require little attention; the sugar-cane, which is usually crowded into small spots, without any order; the mulberry, from which cloth is made, which is allowed an open space, and kept very clean; the pandanus, planted in close rows at the sides of the fields; the yams and plantains, which are put into the ground with great exactness, so as to form squares in every direction. The instruments used for the purpose are nothing more than wooden stakes, flattened and sharpened at one end; and sometimes the largest have a short piece fixed transversely, by means of which they press the implement into the ground with the foot. With these stakes they make small holes for the reception of the roots, and then dig up the surrounding grass. Notwithstanding, however, the fineness of the climate, and the fertility of the soil, there generally occurs a period of scarcity before the gathering of the new fruits, which may be owing to the improvidence of the natives, the deficiency of the produce, or the difficulty of preserving it; and sometimes to the prevalence of insurrections, preventing cultivation, so as often to produce an actual famine.

Though there is no community of goods among them, it is the custom to apply freely for provisions to those who have plenty; and it would be accounted a gross breach of hospitality to refuse, while any stores remained. Should any one be sitting with his family at meat before his house, a stranger passing by will sit down among them without ceremony, and expect a share of the meal.

Habitations.

The houses of the natives are constructed with little ingenuity or taste, and are, properly speaking, nothing more than thatched roofs or sheds, supported by posts and rafters. The floor is raised with earth, smoothed and levelled, and covered with thick matting. Some of them are open on all sides, but generally they are enclosed on the weather side with strong mats, or branches of the cocoa-nut tree interwoven with each other. A thick mat, about three feet broad, bent into a semicircular form, placed edgewise, and sometimes fastened to the beams, encloses a space as a bed-room for the master of the family and his wife; while the rest sleep upon any part of the floor, the unmarried men and women lying in different places; and if the household is large, there are little huts adjoining for the children and servants. The habitations of the lower class are only wretched hovels, scarcely sufficient to shelter them from the weather; but those of the chiefs are more comfortable and commodious, their ordinary dimensions being about 12 feet in height, 20 in breadth, and 30 in length. The house of the second chief in Tongataboo was 50 feet in length, and of an oval form. One large and lofty post was fixed in the centre, and an oval ring of lesser ones were planted round it at equal distances, forming the sides of the building. Upon those posts, layers were fixed, and from these, rafters were extended to the pillar in the middle, thus uniting the whole edifice. The inside of the roof was ornamented with beautiful matting, which was protected by an outer thatch of plantain branches, interwoven like basket work. In rainy weather, screens of matting, made of the cocoa tree, were fastened to the outer posts, but the door-way was left open night and day. The floor was covered with beautiful matting, of so close a texture as to be impervious to insects. The furniture generally consists of some wooden stools, which are used as pillows; two or three wooden bowls for holding their favourite liquor *kava*; baskets of different sizes, into which they put their tools; fish-hooks, &c.; a bundle or two of cloth, a few gourds, and cocoa-nut shells.

Canoes.

They discover more ingenuity in the construction and ornaments of their canoes, which are the most perfect of their mechanical productions, and which surpass in neatness of workmanship all others in the South Sea. They are built of several planks of the bread-fruit tree, sewn together with cocoa-nut line in so neat a manner, that they appear on the outside as if they were composed of one solid piece. The fastenings are all on the inside, and pass through kants or ridges, wrought on purpose on the edges and ends of the different boards. They are of two kinds, double and single. The single canoes are from 20 to 30 feet in length, about 22 inches broad in the middle, and 18 inches deep, with the head resembling the point of a wedge, and the stern terminating in a blunter point. At each end is a kind of deck, extending one third of the whole length; but they are open in the middle. They have all out riggers, and are sometimes navigated with sails, but more generally with paddles, the blades of which are short, and broadest in the middle. The double canoes are composed of two vessels, about 60 or 70 feet long, 4 or 5 broad in the middle, and 3 deep, exclusive of the deck. These are fastened together, about six or seven feet asunder, by strong cross beams, secured by bandages to risings on the open middle spaces, and over these is laid a boarded platform. They are rigged with one mast, with steps upon the platform, which can easily be raised or taken down; and are navigated by a latteen or a triangular sail of mat, extended by a long yard, a little bent or crooked. On the platform is generally erected a little shed or hut for the master and his family; and these frequently contain a moveable fire-hearth, composed of a shallow square trough, filled with stones. These vessels are capable of carrying about 50 persons, and sail at a great rate. They are fitted both for burden and distant navigation, and can scarcely sink in any circumstances, so long as they hold together.

Tools and manufactures.

The only tools which they possess are hatchets or adzes of a smooth black stone; augers made of shark's teeth; rasps composed of a rough fish-skin fastened on flat pieces of wood; and knives made of sharp shells; yet with these defective instruments they produce many articles of neat and curious workmanship, which at once testify their ingenuity and patience.

Their weapons, such as clubs, spears, and darts, are made of hard wood, curiously carved and ornamented. Their stools or pillows, which are made of brown or black wood, are finely polished, and frequently inlaid with ivory. Their cordage is made of the fibres of the cocoa-nut husk, from which they form four or five-inch rope, laid exactly like those of Europe; and fishing lines as strong and even as the best cord. Their small hooks are made entirely of pearl shell, but the larger ones are only covered with it on the back; and the points of both kinds are generally of tortoise-shell. They have small nets of the most delicate texture; and their baskets, made of the same cocoa-nut fibres, are at once durable and beautiful, being generally composed of different colours, and studded with beads made of shells or bones. Their manufacture of cloth and mats, which is the chief employment of the women, is executed with wonderful skill. The cloth is made from the slender stalks and trunks of the paper-mulberry, which rarely grows above seven feet in height, and four fingers in thickness. From these stalks they strip the bark, which, after scraping off the exterior rind, they roll up and macerate in water. It is then beaten with a square wooden instrument, sometimes smooth, and sometimes full of coarse grooves. This operation is frequently repeated; and the pieces, which are generally from four to seven feet in length, and half as broad, are then laid out to dry. These pieces are joined together with the glutinous juice of a berry, and, being then placed over a large piece of wood with a sort of stamp beneath them, are rubbed hard with a bit of cloth dipped in the juice of some bark, which gives to the surface a dry brown gloss, while the stamp at the same time makes a slight impression. This glazing renders the stuff both more durable, and capable of resisting rain. The finer sorts, in addition to this operation, are dyed of different colours, and stamped of different patterns. In this manner they proceed, joining and staining, and gluing spare bits upon any holes or thin spots, till they have produced a piece of cloth of the requisite length and breadth. The mats are of seven or eight different sorts, and excel those of most other countries both in texture and beauty. Some are intended merely for ornament, and are made from the tough membraneous part of the plantain tree; others are worn as a part of dress, and are generally prepared from the pandanus; and a coarser kind for beds and sails is formed from a plant called evarra.

Food.

The food of these islanders consists principally of vegetables, such as cocoa nuts, bread-fruit, plantains, yams, and tarros, a root resembling a carrot. Their chief articles of animal food are hogs, fish, and fowls, which are, however, only occasional dainties, reserved for persons of rank; but the common people frequently eat rats, which abound in all the islands. Their food is generally dressed by baking, and they make several palatable dishes from different sorts of fruit. They sometimes boil their fish in the green leaves of the plantain tree, tied up so as to form a bag, which holds both the fish and the water, thus producing a kind of fish soup. Hogs are generally baked whole, in holes dug in the earth, having the bottom covered with red hot stones about the size of a man's fist. Some of these stones, wrapped in leaves of the bread-fruit trees, being at the same time introduced into the belly of the hog, and the carcase having been placed on cross sticks, and covered with leaves, the whole is closed around with earth, and left, without farther attention, to the influence of the heat. They are not very cleanly, either in their cookery or manner of eating; and, except in families, seldom sit down in companies to a sociable meal. Their usual drink at meals is water, or the milk of the cocoa nut; but they use at breakfast, or as a morning beverage, a favourite liquor named kava, which is prepared in a manner sufficiently disgusting to European feelings. The kava is a species of pepper, which is carefully cultivated around the habitations, and which generally grows to the height of a man. The root of this plant, after being properly cleaned, is split into small pieces, which are distributed among the young people who have clean teeth, to be chewed. Each of these has a leaf placed before him, on which he lays his portion of the masticated root; and, when it is all chewed, the contents of the leaves are emptied into a large bowl. It is then mixed with a proper quantity of water, and squeezed hard with the hands, to press out the liquor; then put three or four times through a fine strainer, made of the inner bark of a tree. It is next served out in cups, made of plantain leaves, and about a quarter of a pint is put into each; but they often continue to drink in considerable quantities. When taken by some of Captain Cook's sailors, it operated like spirits, producing intoxication, or rather stupefaction; but seemed to have very little effect upon the natives.

Dre

The ordinary dress of both sexes of the better class consists of a piece of cloth or matting, several yards in length, wrapped round the body, and fastened below the breast by a peculiar kind of knot, from which it hangs loose down to the knees; and, being tied close with a belt, is sufficiently long for the upper part to be thrown over the shoulders. This, however, is a costly dress, and is not always worn even by the chiefs. That which is more generally in use, is made of the leaves of the gee plant, which are very broad and strong, and which, being finely shredded, are thickly entwined in a belt, and fastened round the waist, from which they hang down to the middle of the thigh like a full fringe. This, with the addition of a few strings of flowers, is commonly the sole dress of the women in their festive dances. The inferior class, however, often wear only the *maro*, which is a belt about four or five inches broad, passed between the thighs, and fastened round the waist; and, especially when engaged in war, in fishing, or any active occupation, this covering composes the whole of their dress. Both men and women occasionally defend their faces from the sun with little bonnets, made of different materials. The ornaments, also, as well as the dress of both sexes, is the same, and consist chiefly of necklaces made of the fruit of the pandanus, and various odoriferous flowers, or of small shells, sharks' teeth, the wing and leg-bones of birds pendant on the breast; rings of tortoise-shell on the fingers, and several of these joined together, forming bracelets, on the wrists; a polished mother-of-pearl shell, or a ring, on the upper part of the arm; and cylindrical bits of ivory, or of reed stuffed with a yellow pigment, as ear-rings. They dye their hair of different colours, brown, purple, or orange, and wear it in a great variety of ways, sometimes growing to its full length, sometimes short on one side and long on the other, sometimes entirely cut away except a single lock on one side, or on the top of the head. The beard is cut short, and sometimes shaved close with sharp shells. Both sexes pluck the hair from their arm-pits, and anoint their body, especially the head and shoulders, with cocoa-nut oil. The women rub a fine yellow powder like turmeric over the whole of their bodies, and have a few blue lines tattooed on the inside of their hands. The men are stained or punctured with these lines and figures from the middle of the belly half way down the thighs; and are also partially circumcised, or rather supercised, by cutting off the upper part of the foreskin. They are all remarkably cleanly in their persons, and bathe frequently in the ponds, which they prefer to the sea, as they reckon the salt water injurious to the delicacy of their skin.

Domestic life.

Polygamy prevails among the Friendly islanders without any apparent limits; and the power of divorce seems to be equally unrestrained. Every man may take as many wives as he can maintain; and also dismiss them when he pleases. The greater part of the commonalty content themselves with one; but the chiefs have generally from four to eight. The young women have no liberty of choice in their matrimonial connections, but are disposed of by the father or his representative. They pride themselves much upon their virginity; and, as a token of that state, wear their hair uncut till they are married. The daughters of the chiefs are, from their birth, placed under the care of women, who may be called duennas; and, even after marriage, similar attendants are provided by the husband. The forms of courtship and marriage are sufficiently simple. The intending husband makes known his wishes to the parents of the other party, sending at the same time a present of provisions. If the present is accepted, which is not always done at the first offer, his proposal is considered as favourably received; the affair is then communicated to the daughter, who, having no power, never attempts to refuse. Upon a day being fixed, the bride is brought in her best apparel, at the head of a large company of females, one of whom, taking her by the hand, places her by the side of the bridegroom, who is waiting with his friends before his house to receive her; and the ceremony concludes with a feast and a dance.

Domestic life.

Sometimes marriages are contracted, like the Jewish espousal, many years before the consummation of the nuptials. Where there are several wives, the children take the rank of their respective mothers; and, in all cases, probably owing to the frequency of divorce, and of illicit intercourse, family dignity descends through the female. Their mode of domestic life, especially among the chiefs, is much after the patriarchal form; and the younger and inferior branches surround the head of the family in one household, and in the greatest harmony. There is much social intercourse among the members of the family, especially in the evenings, when they retire to their mattings, which is commonly done about seven o'clock; but instead of then going to sleep, they are accustomed to converse till ten or eleven with much cheerful pleasantry and shrewdness of remark; and so fond are they of chatting in this familiar manner, that, should one chance to awake during the night, and find another in the same predicament, they will renew the conversation for an hour, and perhaps rouse some of the rest to join in it. Yet, with all this freedom of intercourse, there is a strict observance of proper respect, and even of ceremonious politeness; and the behaviour and language of the higher classes are thus refined and improved above the lower, in the same proportion as in civilized countries.* This may be exemplified by the orderly manner in which the household of a chief is arranged and served at breakfast, which consists in drinking kava, and eating baked yams, &c. and is taken at day-break, as soon as the family rise from bed. The company forms a large circle, sitting cross-legged before the chief, on each side of whom stand the principal servants to direct the preparation of the kava, by the younger persons, while the rest of the company are silently forming their temporary cups of plantain leaf. Persons appointed to the office, then rising from the circle, approach the bowl with those plantain vessels; and when the distributor of the liquor has filled one of them, he asks, "whose kava is this?" The principal domestic replies, "take it to such a one;" and the person, whose name is pronounced, claps his hands, as a signal to the waiter where to convey it. These waiters conduct themselves in the most becoming and regular manner, arranging their apparel with the greatest neatness, walking with all possible grace, and presenting the cups with ceremonious politeness. Other servants, during the preparation of the kava, are busily employed in baking the yams, which are brought in as soon as the liquor is distributed, and placed before the company, who eat their portion, and talk together as they please; and, in all the different steps of the process, the word of command is given and observed with an exactness and attention resembling a regiment at parade. At this entertainment they often continue from day-break to noon, and then lie down and sleep two or three hours. It is a favourite luxury of the principal people, to have their bodies and limbs, while they are asleep, thumped or beaten with the fists of women, who relieve each other during the operation. After rising, they proceed, like too many of the higher ranks in most countries, to contrive amusement for the day.

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* Their manner of bestowing a present, as mentioned by the English Missionary, who resided among them at Tongataboo, shews a high degree of refinement, and may be considered as a parallel to the complimentary style of the Orientals. "If he sent me a pig, those who brought it would say, they had brought a pig, but it was very small, and intended for the servants, if I would permit them, for Mulk Aamair's sake, to accept of it." Compare 1 Sam. xxv. 27.

Amusements.

One of their most favourite amusements is bathing, in which they generally indulge two or three times a day; and they have different water games, in which both sexes join. Two posts are fixed about a hundred yards distance from each other, in a depth of water about four feet; and the company, dividing into two parties, a large stone is placed between them. The contest is, which side shall first drag the stone to their own post; and the divers generally remain a considerable time struggling around the stone, at the bottom of the water. Another bathing diversion consists in going out at high water, when the sea rolls in on their flat shores with great force, and then ride in on the swell, steering themselves on the top of the wave with the utmost dexterity, stretching out one hand like a prow, and guiding themselves with the other like a rudder. When a spectator would apprehend that they must infallibly be dashed lifeless on the beach, they will turn on one side with surprising agility, and darting through the next wave, swim out to sea to renew the sport; or, if tired of the amusement, will shoot through the refluent surge, and land in perfect safety. Another favourite diversion, especially of the chiefs, is rat shooting. The cocoa nut roasted and chewed, is strewed by the servants near the holes of these animals; and the sportsmen take their stand with bows and arrows. By making a squeaking noise like that of the rats, they entice them to come out; and, while they are feeding on the nuts, they take aim alternately, and whosoever kills most in the same number of shots wins the game. Wrestling and boxing matches furnish another source of entertainment; in both of which exercises they have been generally conquerors, when engaged with Europeans, and are particularly remarkable for the good humour which they preserve when worsted. Though a very active people, they frequently spend whole days in luxurious indolence, walking among the plantations, or collecting in one another's houses for the sake of conversation; but these more sedentary days are generally concluded by dancing and singing, which is their most favourite amusement. The chief sends through his district, collecting about 40 or 50 young persons, of both sexes, to dance by torch light with his regular attendants. The women, on these occasions, are clothed with a thin drapery, having their necks and shoulders encircled with wreaths of flowers, and their dark ringlets bespangled with the whitest and most aromatic blossoms. Their dances are said to be beautifully diversified, and to be performed by companies of eighty or a hundred, with the greatest promptness, regularity, and gracefulness of movement. This amusement is frequently continued till midnight, and sometimes till morning, one set retiring to rest, while another rises to dance. It is their great pastime on all occasions, and generally concludes even their ceremonies of mourning. It is however too often performed with little regard to decency, and is generally an incentive to the most licentious excesses. Their music is very simple and pleasing, but extremely monotonous. Their songs are lively and melodious; but their instruments are very defective. One, composed of unequal sized reeds, resembles Pan's pipe. Another is a flute of bamboo, about 18 inches in length, closed at both extremities, with a hole near to each end, and four others in the middle. Into this instrument they blow with one nostril instead of the mouth, and, with only three notes, produce a pleasing simple music. The principal instrument is a kind of drum, formed of a log of wood, hollowed throughout with a long narrow aperture, laid lengthwise upon two solid pieces, and beaten with bamboos of different lengths, so as to yield a sound according to the length of the stick.

Mourning and funeral rites.

They have a variety of ceremonies to express their grief for the dead; but they are of such a nature, that it is difficult to decide, whether they give greater proof of humanity or barbarity. When any of them dies, he is wrapped up in mats and cloth, and interred in burying places called Fiatookas. These are large inclosed spaces, having in the middle a lofty funeral pile, of a pyramidal form, around which the bodies of the chiefs, (for the inferior people have no particular spot of interment) are collected for many generations, and arranged in a style of rude but solemn dignity. When the deceased is a person of distinction, some of his wives, or other relations, are strangled at the moment that his corpse is deposited; and the nearer relatives, in every case, inflict upon themselves many bloody marks of sorrow. The most common way of testifying grief, is to strike their faces and breasts with their hands; and many of them have scars on their cheek bones, resembling a circle produced by burning, occasioned by the frequent abrasion of the skin. At other times they strike a shark's tooth into their foreheads, beat their teeth with stones, and even thrust spears through their cheeks, or into their sides and thighs. Around the graves of their kings and principal chiefs, they often mangle one another in a kind of bacchanalian frenzy, of which the following account is given by one of the missionaries, who resided lately among them for several years. "The space round the tomb was, on this occasion, a palæstra for savage gladiators. Hundreds ran about it with ferocious emulation, to signalize their grief for the venerated chief, or their contempt of pain and death, by inflicting on themselves the most ghastly wounds, and exhibiting spectacles of the greatest horror. Thousands, ere the period of mourning was over, fought with each other, and cut themselves with sharp instruments. It was an awful scene indeed! Night after night we heard, for some weeks, the horrid sound of the conchshell rousing these deluded creatures to these dreadful rites of mourning for the dead; and shrieks and clashing arms, and the rushing and violence of the multitude, re-echoed round our abode, and rendered it a scene of continual horror and alarm."

Natives.

The natives of the Friendly Islands seldom exceed in stature the common size of Europeans; and are generally strongly built and well proportioned in their figure, their shoulders are broad, and their whole form conveys the idea of strength rather than of beauty. They have good eyes and teeth, and are free from that uncommon thickness about the lips, which is found among the inhabitants of the other islands in the Pacific. Their hair is thick, straight, and strong, though sometimes bushy and frizzled; and its natural colour is black, but many of them stain it of a white, brown, purple, or orange hue. There is observable among them a great variety of features, many Roman profiles and European faces; and the only general likeness which characterises them is a fulness at the point of the nose. The general colour of their skin is a cast deeper than copper brown; but several of them have a true olive complexion. The greater part of the people have a dull hue, and a degree of roughness on the surface of the body, especially where

Friendly Islands. Natives.

it is uncovered; but, in the higher classes, there is a softer and clearer skin, with a tendency to corpulence. The women are distinguished from the men, less by their features than by their form. Sometimes, indeed, their countenances are both delicate and expressive; but they are more remarkable for the elegance of their figures, which are usually well proportioned, and often perfect models of female beauty: The smallness and delicacy of their hands, seems to be their principal distinction. Both sexes are strong and active, and have a very graceful mien, and great firmness of step when they walk. Few natural defects or deformities are to be seen among them; and they appeared to all the navigators, who have visited their coasts, to be remarkably healthy. Though extremely attentive to personal cleanliness, they are most liable to cutaneous diseases, particularly to the *terter* or ring-worm, which leaves whitish serpentine marks upon their bodies. They are frequently affected also with tumours in the testicles, and swellings on their legs and arms; but a species of venereal disease, which covers their bodies, and particularly the face, with broad ulcers, is the worst of their maladies. They have always evinced a very pacific and friendly disposition towards strangers, and observed the greatest uprightness in their traffic; but all of them, of whatever age or sex, are remarkbly addicted to theft from their European visitors, and display the utmost dexterity, and sometimes murderous ferocity in the practice. When detected and punished, they shewed the most complete insensibility, both to the shame and the bodily suffering inflicted on them. The utmost mildness and good nature is depicted on their countenances; and they preserve a degree of self-command in their conduct, very unusual in the savage state. They are, at the same time, chearful, open, and good humoured; and the females particularly are unusually merry and talkative. They were described, in short, by their first European visitors, as a people not only adorned by all the gentler virtues, but also as possessing many of the most estimable qualities of human nature; but more recent information proves them to be capable of the most ferocious excesses, and overturns all the declamations, founded upon their character, in favour of uncivilized society. In their wars, particularly, they present all the features of barbarians; and the fiercest savages of America are not more merciless towards hostile tribes, than these Friendly islanders are to one another in their intestine commotions. One of the common modes of warfare among them is to "*tootang*," as they express it, that is to come upon the adverse party by surprise, to massacre in secret, to carry off plunder, to cut down the plantains and cocoa-trees, and to commit every species of devastation. Women, children, and prisoners, are murdered without mercy; and the dead bodies, after being exposed to the most brutal indignities, are roasted and devoured with voracious satisfaction. Their cruelties are perpetrated with the most wanton levity; and more than ordinary barbarism was witnessed by one of the English missionaries, who had adopted their customs, and joined in their expeditions. "Spectacles too shocking for humanity to contemplate, soon sickened my sight, and sunk my spirits: I beheld, with shaking horror, large stacks of human bodies piled up, by being laid transversely upon each other, as a monumental trophy of the victory. Proceeding a little farther, a horrid spectacle almost froze my blood. It was a woman in a sitting posture, with folded arms, holding a child to her breast, as in the act of suckling it. Upon approaching them, I found both the mother and child cold and stiff with death. The enemy had killed them while in this posture, and indulged their savage revenge in amusing themselves with placing the dead bodies in this affecting attitude." In the course of the civil war to which this extract refers, several of the missionaries stationed in Tongataboo were cruelly butchered, while harmlessly looking upon a victorious party, who were passing their habitation; and while the facts above related clearly shew how unadvisable it is to establish Christian teachers where their persons are exposed to lawless violence, they prove, at the same time, how much the humanizing influence of their doctrines is needed, by those who have been most highly extolled as the inoffensive children of nature. See Cook's *Second Voyage round the World*, 4to. vol. i. p. 211; Cook's *last Voyage round the World*, vol. i. p. 141, 267, 285; *Authentic Narrative of four years residence at Tongataboo;* Wilson's *Missionary Voyage in the Ship Duff.* (*q*)

Friesland.

FRIESLAND, WEST, in ancient times called *Frisia*, one of the seven united provinces, is bounded on the north by the German Ocean; on the south by Overyssel and the Zuyderzee; on the west by the Zuyderzee; and on the east by Ommeland, Drenthe, and Overyssel. It lies between 52° 45′ and 53° 30′ of North Latitude, and between 5° 8′ and 6° 5′ East Longitude from Greenwich; extending from 10 to 13 leagues from north to south, and nearly the same distance from west to east. It is divided into four quarters; namely, Oostergo, Westergo, Zevenwolde or Seven Forests, and the islands on the north coast. It contains about 100,000 inhabitants; and sends five of the 55 representatives, who compose the assembly of the states-general. Oostergo, the north-east quarter, is divided into 10 districts; Leeuwerderdeel containing 14 villages; Ferwerderodeel containing 11; West Dongerdeel 14; Kollumerland 6; East Dongerdeel 14; Dantumadeel 12; Tzetjerksteradeel 15; Smallengerland 7; Idaarderadeel 8; Aauwerderahem 6. Westergo is divided into nine districts; Het-bilt, containing 9 villages; Harlingen 8; Wonseradell 27; Waterland 9; Wymbritzerdeel 28; Hennarderdeel 12; Baarderdeel 16; Menaldumerdeel 12; and Franekerdeel 11. Zevenwolde is divided into 10 districts; Gaasterland containing 8 villages; Haskerland containing 7; Utingerdeel 7; Doniawerstal 14: Opsterland 13; Angwirden 5; Schoterland 18; Stellingwerf-Oosteinde 10; Stellingwerf-Westeinde 20; and Lemsterland 5. The largest of the islands on the north coast of the province is Ameland, which is about four leagues in length, and one in breadth, and contains several villages, Hollum, Ballum, Nes, &c. The principal towns in Friesland are situated on the north-west coast, namely, Leeuwarden, the capital of the province, a well built town, about 25 leagues N. E. of Amsterdam, and containing 2000 inhabitants; Franeker, a small but handsome trading town, the seat of an university, and about 3½ leagues west of Leeuwarden; Harlingen, a fortified and populous place, with a convenient harbour, but of difficult access, about 20 leagues north-north-west of Amsterdam, and containing 7000 inhabitants; Dockum, an ancient and neatly built trading town, situated in a fine corn country, containing 3000 inhabitants, and about four leagues north-north-east of Leeuwarden; Bolswert, a small but ancient town, celebrated for its manufacture of baize or light woollen stuffs, containing 2000 inhabitants, and about 4½ leagues south-west of Leeuwarden; Workum, a small open town, surrounded by a ditch, and celebrated as the birth-place of Lambert de Bos, about 7 miles south-west of Bolswert; Staveren, anciently the residence of the Frisian kings, now an inconsiderable place in a marshy country, near the south-west point of the province, and about 7 leagues south of Harlingen; and Slooten, a small, but regular, and trading town, surrounded by lakes, and 4 leagues east of Staveren.

The ancient inhabitants of Friesland were distinguished by the obstinate defence which they made of their liberty, against the power of the Roman emperors, and by their repeated attempts to shake off the yoke of their conquerors. After the death of Drusus, by whom they had been compelled to submit, and after having been 40 years in subjection, they expelled the Romans from their province, and even made encroachments on the territories of the empire. Their ambassadors repaired, with the utmost boldness, to the court of Nero; asserted in his presence that they were excelled by no nation in equity and valour; professed their desire to live in friendship with the Romans, but not in subjection; and even demanded a place in the public theatres, to which they understood they had a right as ambassadors. Though driven back by the Romans, and obliged to confine themselves within their ancient boundaries, they continued for a long series of years to maintain their independence as a state; but, towards the decline of the empire, they fell under the dominion of the Franks. About the beginning of the 8th century, Adalgise, who is considered as the first Christian king of Friesland, refused to pay homage to the Franks, and a war ensued. Radbode, his son, was defeated by Pepin; but so recommended himself by his valour to the esteem of the conqueror, that he received his daughter in marriage. Charles Martel, afterwards attempting to reduce the Frieslanders, was routed with great slaughter, and left them for a time unmolested. Returning, however, with a numerous army, and wearing them out by a succession of bloody battles, he compelled them at length to acknowledge his superiority, but not his sovereignty. Under Charlemagne they were still farther subdued, and obliged to pay an annual tribute of thirty pounds of silver. As now a province of the Franks, the country was governed by counts or lieutenants, with the title of Potestas or Podestad; but, under their first governor Forteman the Great, they rendered such essential services against the Saxons, that Charlemagne exempted them from every mark of servitude, and left them free to choose their own form of government. They made no alteration, but continued Forteman in his office. About the middle of the ninth century, the province was repeatedly ravaged by the Normans and the Danes; but the valour of the people finally prevailed, and cleared their coasts of every invader. In the year 935, William, Earl of Holland and King of the Romans, bestowed many valuable privileges upon the inhabitants of Friesland, in hopes of gaining their affections, and persuading them to acknowledge his sovereignty. But the Podestad Sierdama, supported by a powerful body of his countrymen, declared that they would never betray their country to gratify an emperor, and struck a medal expressive of their determination to be free. This was construed as an affront by William, who twice led his army into the province, and was slain in his second expedition. One of the most warlike of the Friesland Podestads was Martena, from whom many of the noble families in the province trace their descent. This active chief baffled all the exertions of the Hollanders to gain possession of the country, and frequently carried his victorious arms into the territories of the invaders. After his death, the election of a successor gave rise to two violent factions, whose contentions filled the country with confusion; and, together with the pressure of a war with Albert of Bavaria, reduced the province to so low a state, that several persons refused to accept the office of Podestad. At length, to please both parties, two governors were elected, one from each faction; but this measure, instead of promoting reconciliation, served only to aggravate their animosities, till at last they had recourse to arms, and seemed to be bent only upon extirpating one another. These dissensions reduced Friesland to the verge of destruction, and were the means of its becoming subject, in 1417, to Sigismund, Emperor of Germany. At the termination of a long war between Joan of Bavaria, and Philip the Good of Burgundy, the province of Friesland was gained by the house of Bourbon. It became subject afterwards to the house of Austria; and never recovered its freedom till the general revolt in the Netherlands gave birth to the republic of the United States, of which, since that period, it has formed one of the seven provinces. The inhabitants are said still to retain that ardent love of freedom, by which their ancestors were so distinguished, together with many of their ancient customs and modes of living. Even their dialect and accent are said to be peculiar, and the language of the peasantry, in particular, is often unintelligible to the other inhabitants of the Low Countries.

The province of Friesland is a flat country, and the north-west coast particularly being below the level of the sea, is secured against the encroachments of the ocean by very strong dikes, constructed and preserved at a vast expence. In former times, when the care of these dikes was left to the proprietors of the adjoining estates, they were often suffered to fall into decay, and the most destructive inundations were frequently the consequence of this neglect. In order to preserve themselves and their effects in such calamities, the inhabitants, in the want of natural sand hills, constructed circular eminences about twenty or twenty-five feet in height, upon which at length they gradually built their habitations, so that many of the towns and villages of the province are now situated on these artificial mounds. Since the year 1570, when the dikes were all raised and strengthened at the public expence, these irruptions of the sea have been less frequent and fatal.

Friesland very much resembles the provinces of Holland in its climate and soil. The country has been originally full of marshes; and many lakes are still found in the south-west districts; but in the south-east are several extensive heaths and woods. The whole country is now intersected with canals, which at once carry off the superfluous water to the sea, and facilitate the intercourse of traffic. One of them extends from Harlingen to Lieuwarden, and thence by smaller branches to Groningen; and another passes from Slooten to a small gulf on the south coast. The north-west districts abound in excellent pastures; and, in these quarters, immense quantities of butter and cheese are produced. The cow-pock is said to have here been known among the peasantry from time immemorial. Besides excellent cows, sheep, and oxen, number of large horses are reared in these pastures, and sent for sale to Germany and other countries. In the more elevated parts good corn land is found, and the wheat which it produces is greatly esteemed for the whiteness of its flour. Barley, pease, and potatoes, also are commonly raised; but oats and hemp are the principal products. The inhabitants, however, derive their chief support from the fisheries, which are numerous along the coast. Friesland is famed for its woollen stuffs, and still more for its linens, which are said to be the finest in Europe. The fuel principally used in the country is peat or turf, but of an inferior kind to that which is found in Holland. See *Modern Univ. Hist.* vol. xxxi.; and Playfair's *Geography*. (*q*)

FRIESLAND, EAST, a principality in the circle of Westphalia, is bounded on the north by West Friesland and the German Ocean, on the east by Oldenburg, and on the south by the bishopric of Munster, and on the east by Groningen. It lies in 53° 20′ North Latitude, and 7° 20′ East Longitude, extending 40 miles from north to south, and nearly the same distance from west to east. It contains several towns, and about 103,000 inhabitants. The principal towns are, Aurich, in the centre of the country, defended by a castle, surrounded by a marshy territory, and by forests full of game, formerly the prince's residence, and containing 2000 inhabitants. Norden or Noorden, an old, unfortified town, near the north-west extremity of the country, about three miles from the coast, and 17 north of Embden, has a tolerable harbour and a little trade. Embden, a flourishing sea-port, near the mouth of the Ems, and 28 miles east of Groningen, is the largest town of East Friesland, tolerably well built and fortified, situated in a fertile tract of country, and containing 8000 inhabitants. The harbour is excellent, and the trade of the place considerable, especially in cheese, linens, and wines. Frederick the Great of Prussia exerted himself anxiously for the extension of its commerce; and, in 1750, established an East India company. But his forcing system did not comport with the republican spirit of the people; and many of his schemes were very ineffectual. The herring fishery, which he laboured to encourage, has succeeded well, and brings in great sums annually. Jengum, a wealthy town on the river Ems, about 11 miles south-east of Embden, is remarkable chiefly for having been the scene of several battles. Leer or Lehr, a well built manufacturing town on the Seda above its confluence with the Ems, and 15 miles south-south-east of Embden, is situated in a marshy but fruitful country, and contains 4500 inhabitants. Strickhausen, a citadel built by the city of Hamburg, about 9 miles east of Leer on the river Seda, is 24 miles south-east of Embden. Friedburg, a fortress on the frontier of Oldenburg, 26 miles east of Embden, is situated in a heathy and marshy soil, and is now in a ruined state. Essens, on the sea-coast, 21 miles north-east of Embden, is a tolerably well built town, with an old citadel. Witmund, a small burgh and citadel in the north-east corner of the principality, between Essens and Friedburg. There are many small islands along the north coast, viz. Juyst, Norderney, Baltrum, &c. The country of East Friesland is a low, flat, and generally marshy or sandy territory. The tracts along the coast, and on the banks of the rivers, have a bottom of clay or mud, and are extremely fertile, abounding in excellent pastures; but the inland parts are chiefly sandy, heathy, and marshy, in which great quantities of peat are dug for fuel. The climate is cold, the seasons late; and the inhabitants have a stunted appearance; small round figures, yellow complexions, and flaccid bodies. The fowls, cattle, sheep, and horses, on the contrary, are of a large breed; and numbers of the latter animals are exported for heavy cavalry and coaches, even to Russia and Italy. There are few corn fields in the country, and butter and cheese are the principal products of the farms. One third of the whole is uncultivated, and there is great abundance of game. The river Ems traverses the south-west district; and contributes essentially to the trade and prosperity of the country. The chief articles of commerce are horses, horned cattle, cheese, butter, oats, beans, rape-seed, and fine linen. The prevailing religion is Lutheran, but the Catholics, Moravians, Jews, &c. are freely tolerated. See Riesbeck's *Travels in Germany*, vol. iii.; and Playfair's *Geography*. (*q*)

FRODSHAM, a small town of England, in the county of Chester, is agreeably situated on a rising ground near the confluence of the rivers Weaver and Mersey, and beneath the hills which form the northern extremity of Delamere Forest. The town consists of two wide and well paved streets, intersecting each other at right angles; and at the upper extremity of one of them, upon very high ground, stands the church, which is an old and handsome building. It was repaired and beautified in 1790. Near the church is a school, with an excellent house for the master, having a cupola for the purpose of erecting an observatory. Beacon Hill, which stands behind the school, commands a fine prospect of the estuary of the Dee and the remote parts of Lancashire. The hill is now cut out into walks, which lead gradually to the summit. There are butts for the practice of archery at the foot of the hill. Frodsham Bridge, over the Weaver, is about a mile to the east of the town; and at some distance from it, on the river side, are works for the refining of rock salt, which give some employment to the inhabitants. There is a small cotton manufactory in the town, and a graving dock and yard have lately been erected for building and repairing vessels. One of the springs which supplies the town with water discharges 1700 gallons in a minute, and is used as a cold bath. Great quantities of potatoes are cultivated in the parish, amounting sometimes to 100,000 bushels, of nearly one hundred weight each, annually.

The following is the population of the township and lordship together for 1811.

Number of houses		388
Do.	of families	416
Do.	employed in agriculture	270
Do.	in trade, &c.	72
Males		1037
Females		1068
Total population		3105

See *Beauties of England and Wales*, vol. ii. (*w*)

FROME, or FROME SELWOOD, a town of England, in the hundred of Frome and county of Somerset, is situated on several abrupt hills, at the bottom of one of which is the principal entrance to the town, by a good stone bridge of five arches across the river. The town is irregularly built; and the streets, which are numerous, are narrow and ill paved. The houses are built of small rough stones, and are covered with heavy stone tiles, dug in the adjacent quarries. The church of Frome, situated in the east of the town, is a large and handsome building: it is 150 feet long and 54 broad, and consists of a nave, a chancel, north and south aisles, and four chapels. A quadrangular tower, with a neat octagonal stone spire 120 feet high, stands on the south side of the entrance to the nave from the chancel. The chancel is very elegant, the area round the communion table being paved with black and white marble. The altar piece is placed in a fine oval window, and represents a female pelican with three young ones, all superbly gilt. The organ at the west end is very handsome. Besides this church, there are meeting-houses for the Baptists, Independents, Presbyterians, Quakers, and Methodists.

There are at Frome several alms-houses and other charitable institutions. Among these is a charity school, which stands near the bridge, and is a large and handsome building of freestone. There is also a free-school, founded by Edward VI. Vallis House, the ancient seat of the Leversedges, stands on the west skirts of the town, and near it is a beautiful romantic vale, called Vallis Bottom, which runs in a serpentine direction to Mells.

The principal manufactures of Frome, are broad cloths and kerseymeres, which are made to the extent of nearly 150,000 yards annually. There are several mills for fulling, and for the rolling of iron, &c. on the banks of the river; and knitted worsted stockings, and wool cards, are likewise made. There are in the neighbourhood, mines of coal, lead, manganese, and a variety of useful clays. Frome has long been celebrated for its fine strong beer; and, at the sign of the Bell, a cask is kept as a curiosity, which contains no less than 600 puncheons. The position of Frome steeple, according to trigonometrical observations, is West Long. 2° 18′ 4″, and North Lat. 51° 13′ 47″.

The following is the population of the parish, in 1811.

Number of houses,	1722
Number of families,	1909
Families employed in agriculture,	222
Ditto in trade and manufactures,	1333
Males,	4179
Females,	5314
Total population,	9493

See *Beauties of England and Wales*, vol. xiii. p. 462, and Collinson's *History of Somersetshire*. (w)

FRONTINUS SEXTUS JULIUS. See *History of* HYDRODYNAMICS.

FROST. See METEOROLOGY.

FRUCTIFICATION. See BOTANY.

FRUIT TREES. See GARDENING.

GENERAL EXPLANATION

OF THE

PLATES BELONGING TO VOLUME NINTH

OF THE

EDINBURGH ENCYCLOPÆDIA.

PLATE CCLIII.

Contains various Diagrams illustrative of the properties of Cycloidal and Epicycloidal Curves.

PLATE CCLIV.

Fig. 1. to Fig. 6. Represent Dr Yule's View of the germinating Seed and Embryo of Ferns.

Fig. 7. Represents a Transverse Section of the creeping Stem of *Aspidium filix mas.*
- (*a*) Exterior cellular substance.
- (*b*) The central cellular substance.
- (*c*) The roots.
- (*d*) Central fasciculi.

Fig. 8. Longitudinal Section of the Stem of *Davallia Canariensis.*

Fig. 9. Represents a pinnule of *Athyrium Thelypteris.*

Fig. 10. Is a highly magnified view of a Capsule, with the Yellow Globular Bodies, supposed to be male Organs, by Schmidel and Hedwig.

Fig. 11. Is a Capsule with its Ring beginning to burst and eject the Seeds.

Fig. 12. Represents the DANEACEÆ.
- (*a*) Part of a pinnule of *Marattia Alata*, magnified.
- (*b*) Seed Vessel, also magnified.
- (*c*) The half of the same, to shew the divisible septum.

Fig. 13. OSMUNDACEÆ.
- (*a*) A pinnule of *Osmunda regalis,* bearing the capsules.
- (*b*) A capsule magnified.

Fig. 14. POLYPODIACEÆ. The naked groups of capsules in which the vascular fasciculi terminate, and the vessels connected at the knobs, supposed by Bernhardi to be male organs.

Fig. 15. ASPIDIACEÆ. (*Vide* Fig. 9.)

Fig. 16. ASPLENIACEÆ.

Fig. 17. BLECHNIDEÆ.

Fig. 18. ONOCLEACEÆ.

Fig. 19. PTERIDEÆ.

Fig. 20. CYATHEACEÆ.

Fig. 21. 22. BOTRYCHIACEÆ.

PLATE CCLV.

Contains various Diagrams illustrative of the Doctrine of Fluxions.

PLATE CCLVI.

Contains various Diagrams illustrative of the Doctrine of Fluxions.

PLATE CCLVII.

Contains Figures illustrative of the Article Fortification.

PLATE CCLVIII.

Contains Figures illustrative of the Article Fortification.

PLATE CCLIX.

Contains Figures illustrative of the Article Fortification.

PLATE CCLX.

Fig. 1. Represents the Vitrified Fort on the Top of Duncreich, in the County of Sutherland.

Fig. 2. Is a Plan of the Vitrified Fort on Knock Farril, in Ross-shire.

Fig. 3. Is a Sketch of the Country about Duncreich.

END OF VOLUME NINTH.

EDINBURGH:
Printed by A. Balfour.

EPICYCLOID.

PLATE CCLIII.

Fig. 1.

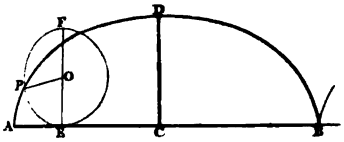


Fig. 2.

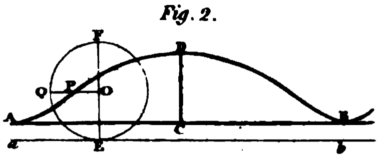


Fig. 3.

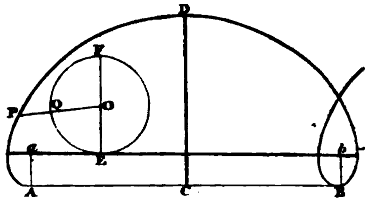
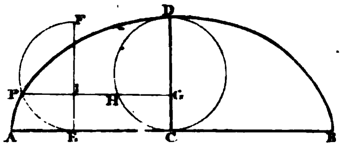


Fig. 4.



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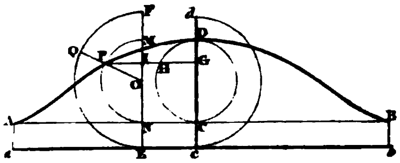

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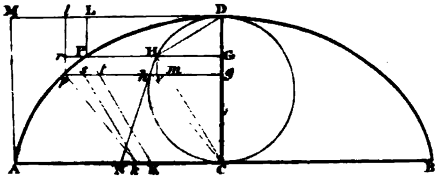

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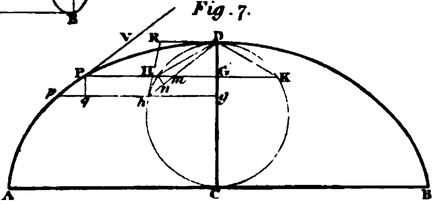

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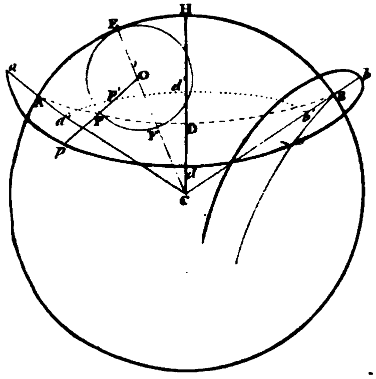

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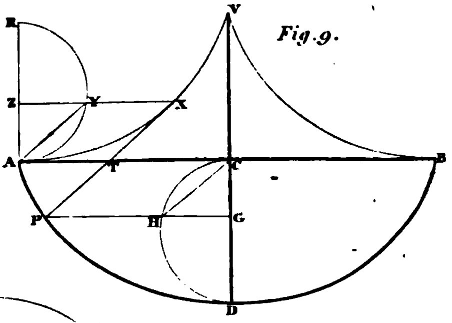

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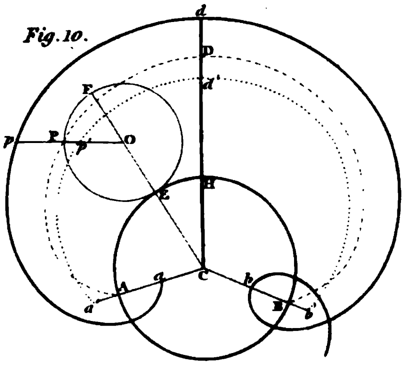

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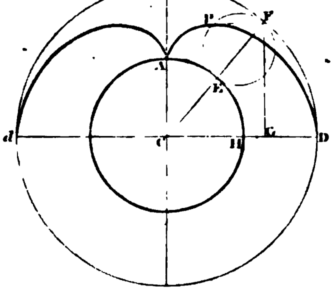

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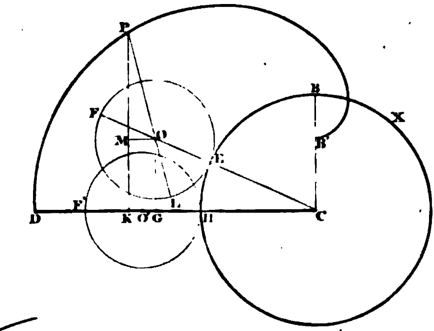

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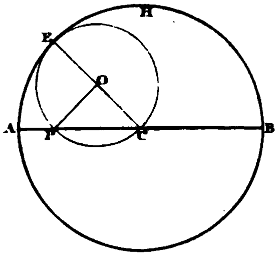

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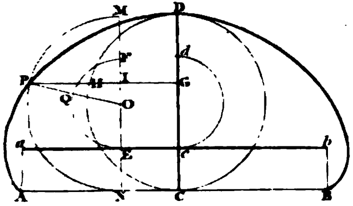

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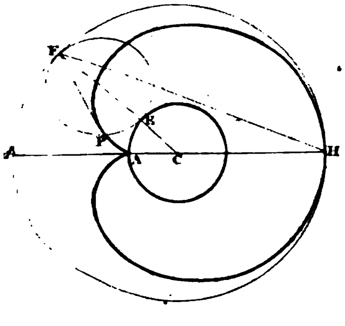

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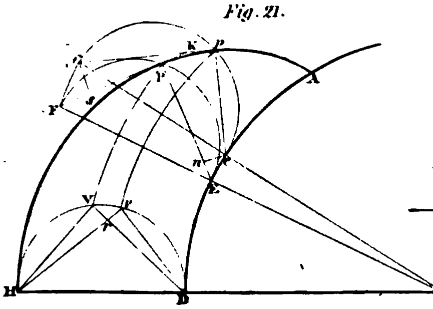

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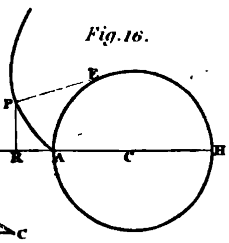

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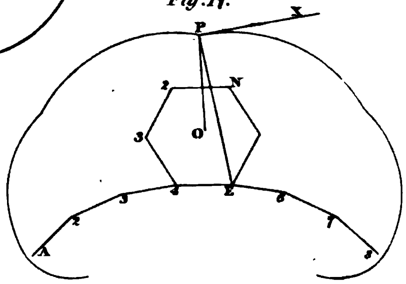

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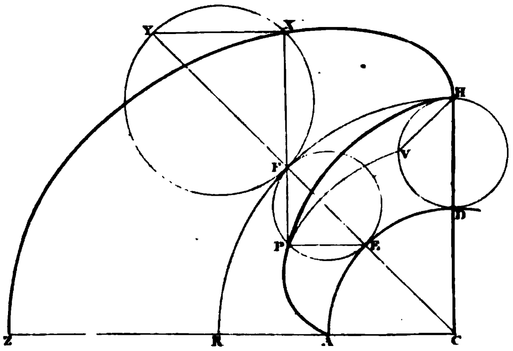

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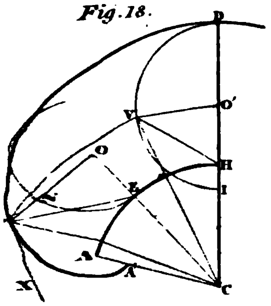

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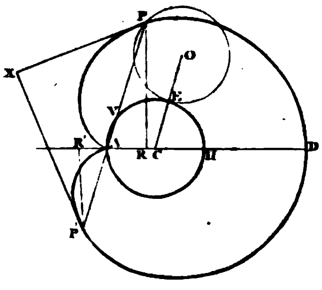

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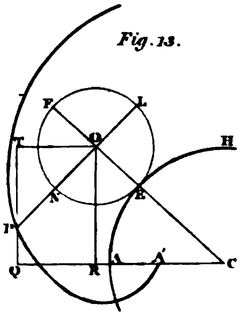


From Original Drawings for the Edinr. Encyclopaedia

Engd. by J. Moffat.

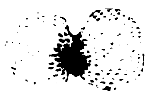
FILICES.

PLATE CCLIV.

VIEW of the GERMINATION, STRUCTURE and ARRANGEMENT of FERNS by J. YULE. M.D.F.R.S.Edin^r.

Fig. 1.

Fig. 2.



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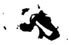

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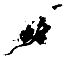

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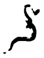

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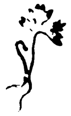

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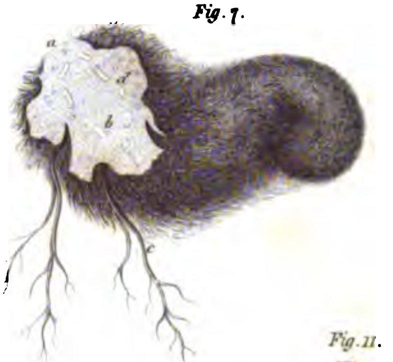

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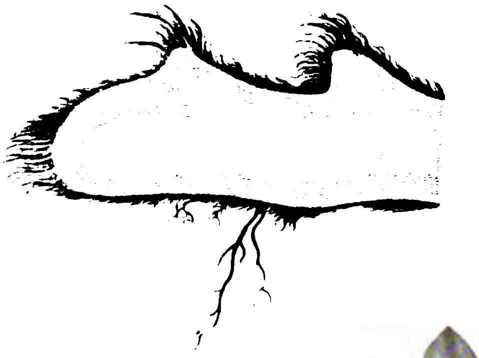

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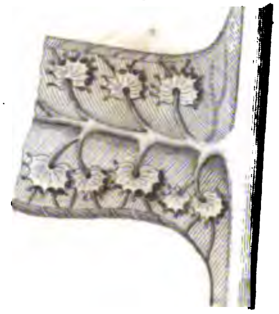

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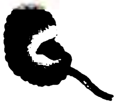

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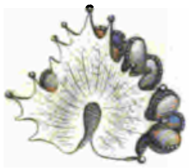

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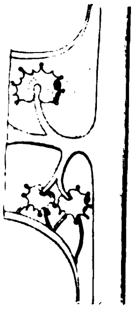

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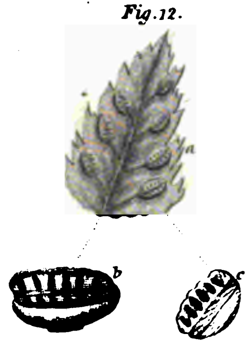

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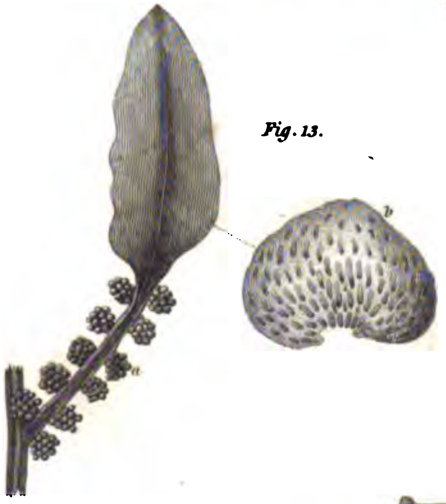

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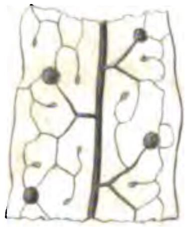

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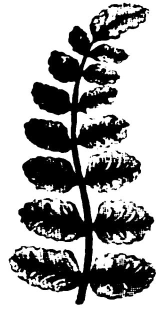

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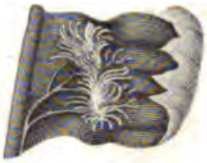

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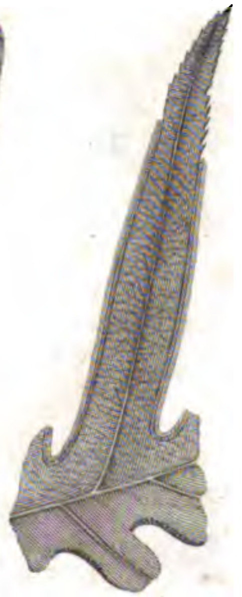

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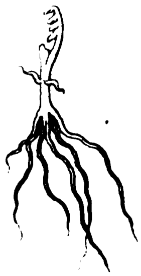

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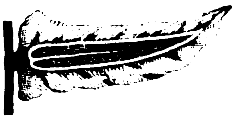

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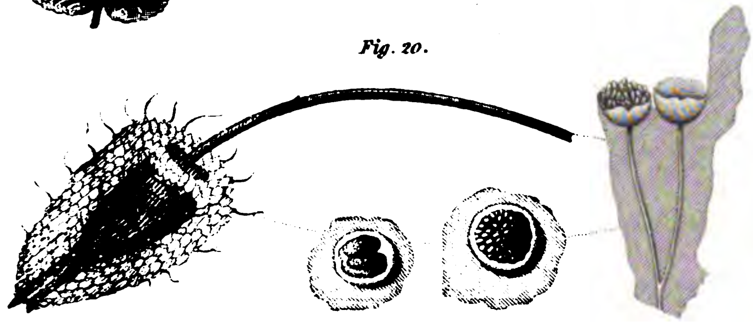

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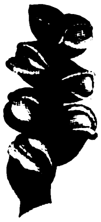


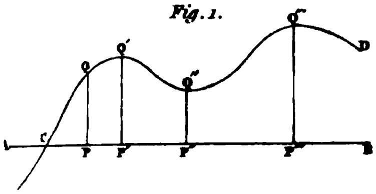
Fig 1 to 8 Drawn by P Syme for the Edin^r. Encyclopædia.

Eng^d. by J. Moffat Edin^r.

FLUXIONS.

PLATE CCLV.

Fig. 1.



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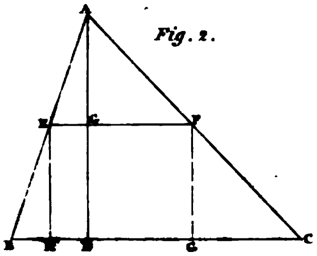

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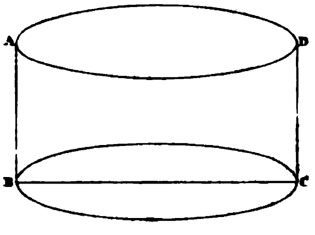

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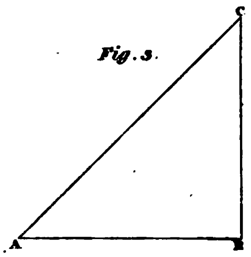

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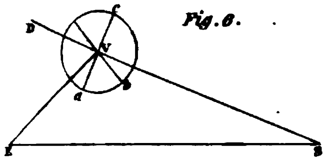

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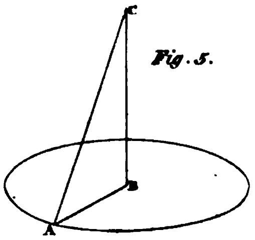

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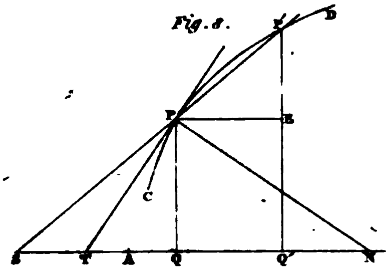

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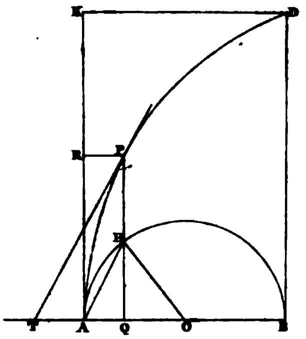

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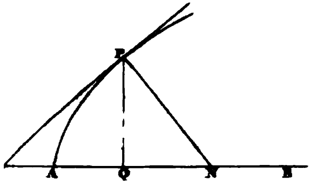

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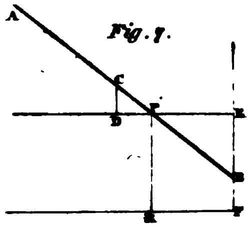

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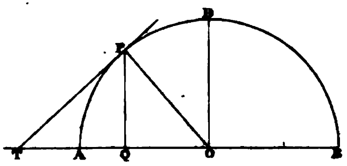

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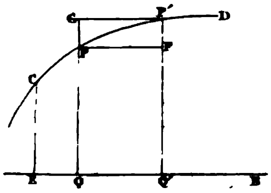

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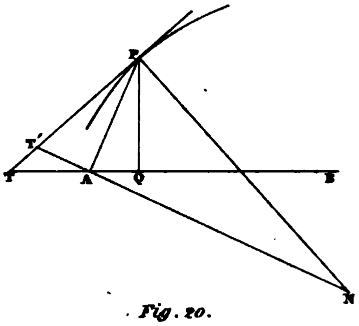

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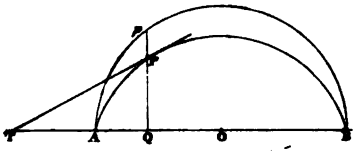

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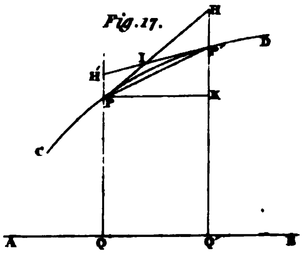

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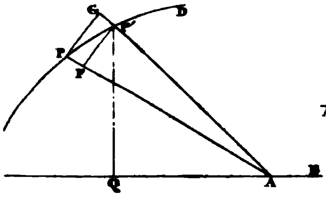

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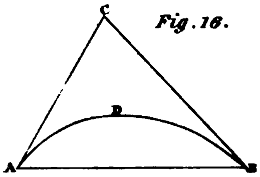

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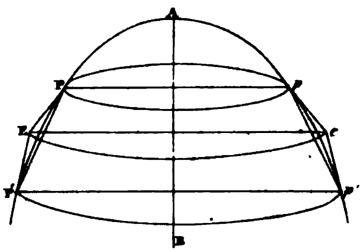

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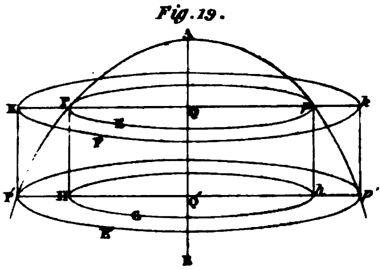

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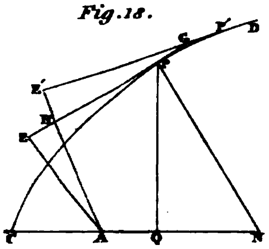

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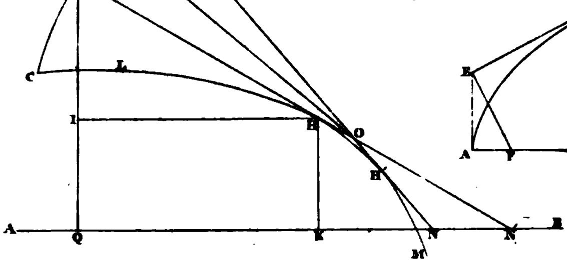

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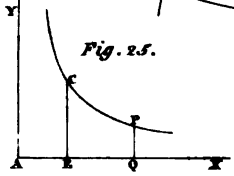

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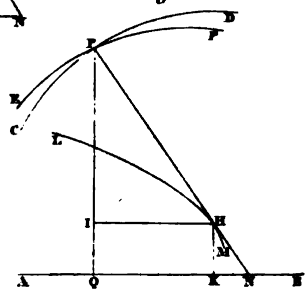

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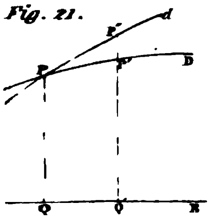

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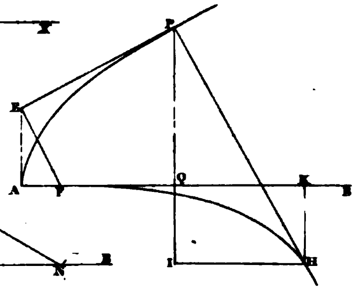

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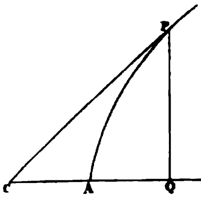
Engd by J. Moffat Edinr

FLUXIONS. PLATE CCLVI.

Fig. 26.



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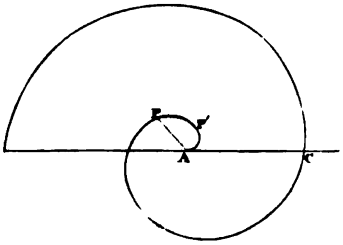

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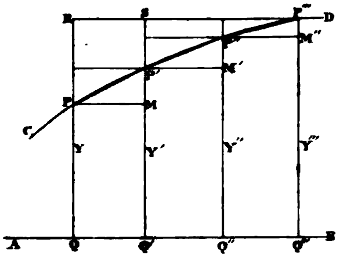

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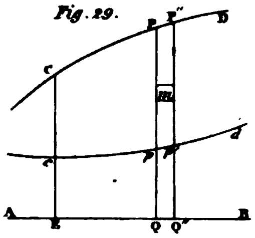

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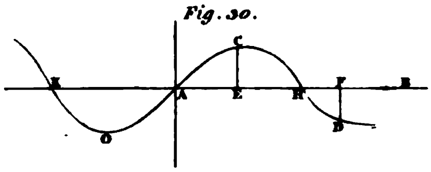

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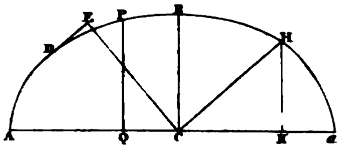

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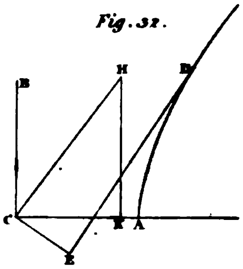

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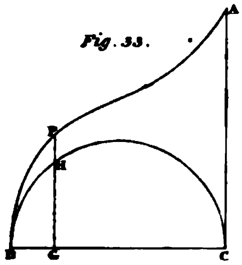

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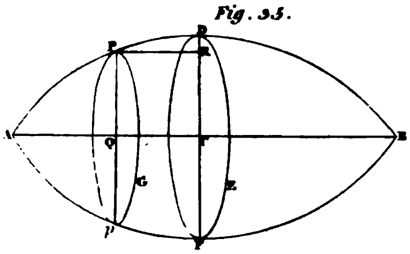

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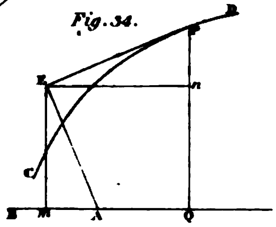

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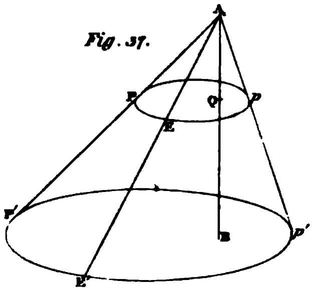

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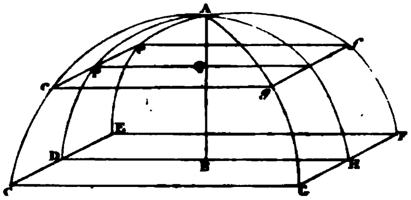

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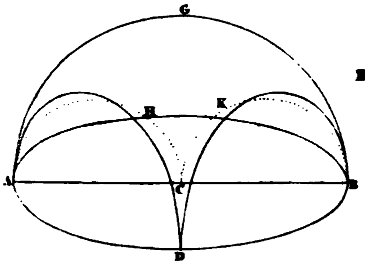

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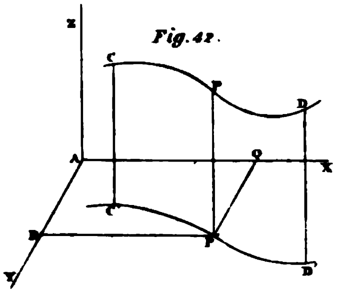

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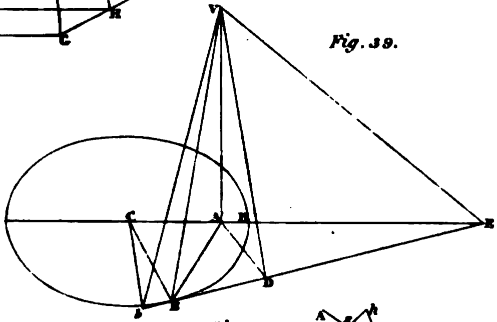

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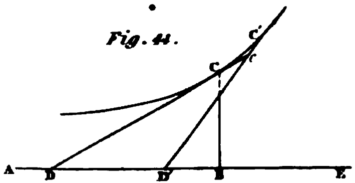

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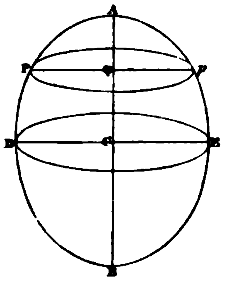

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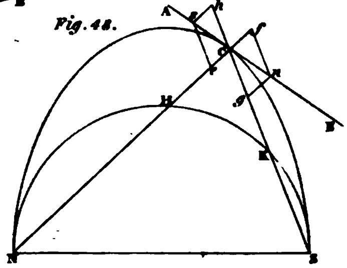

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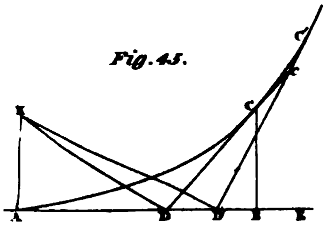

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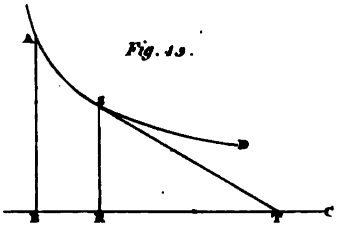

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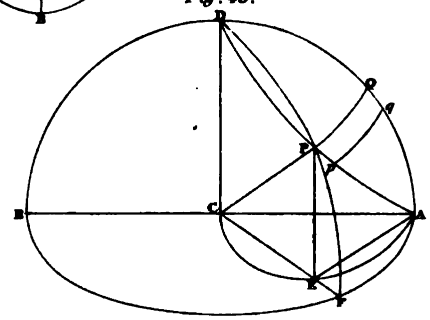

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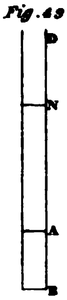

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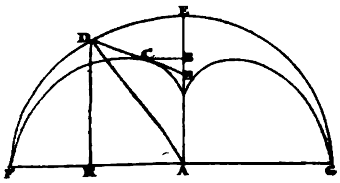

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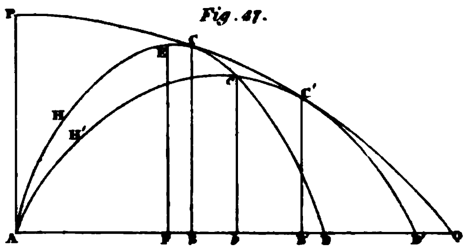

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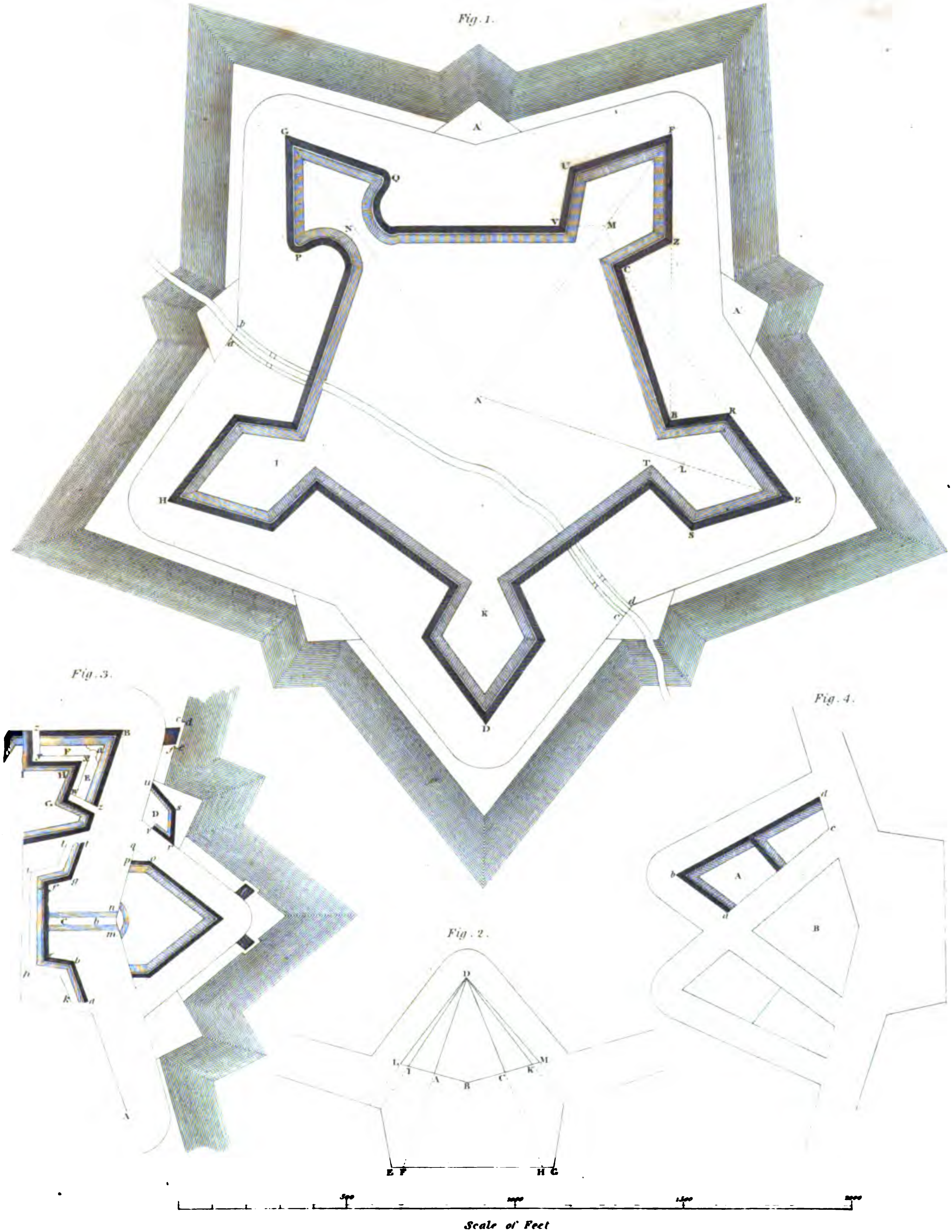
FORTIFICATION. PLATE CCLVII



Drawn for the Edinr Encyclopædia

Engd by J.

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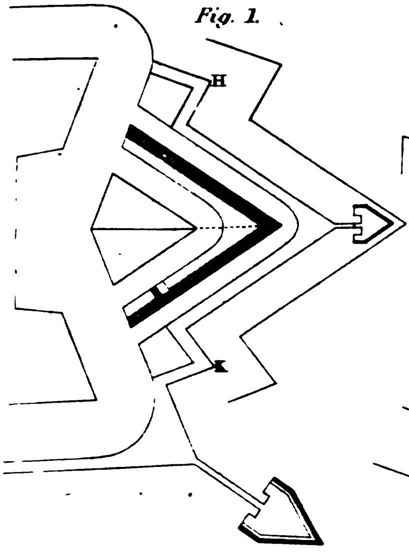

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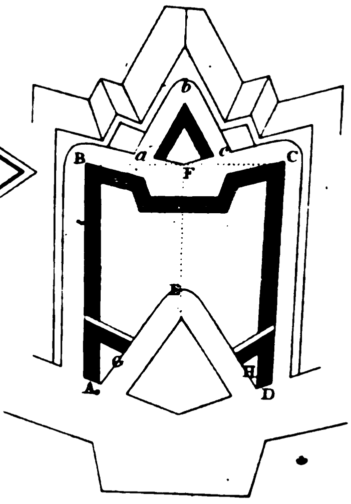

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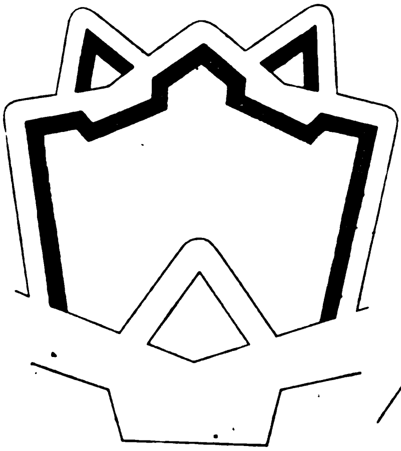

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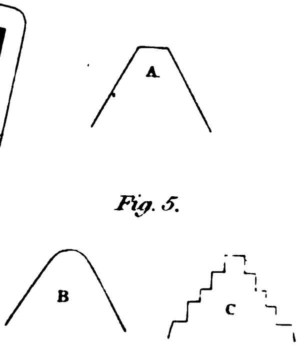

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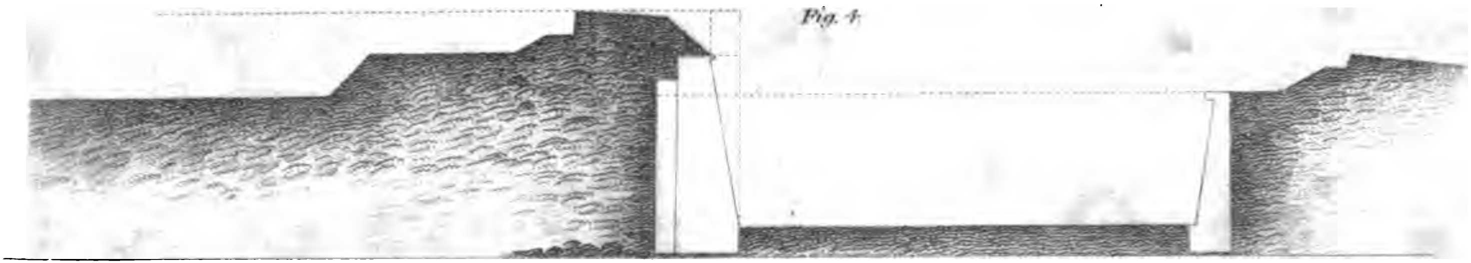

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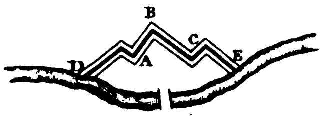

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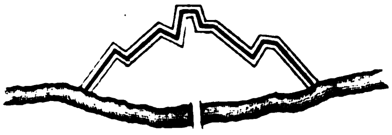

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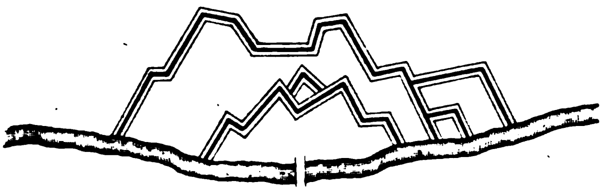

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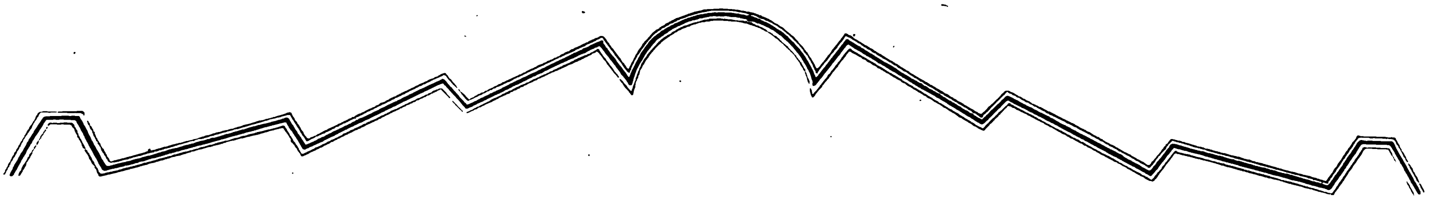

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PLATE CCLIX.

FORTIFICATION.

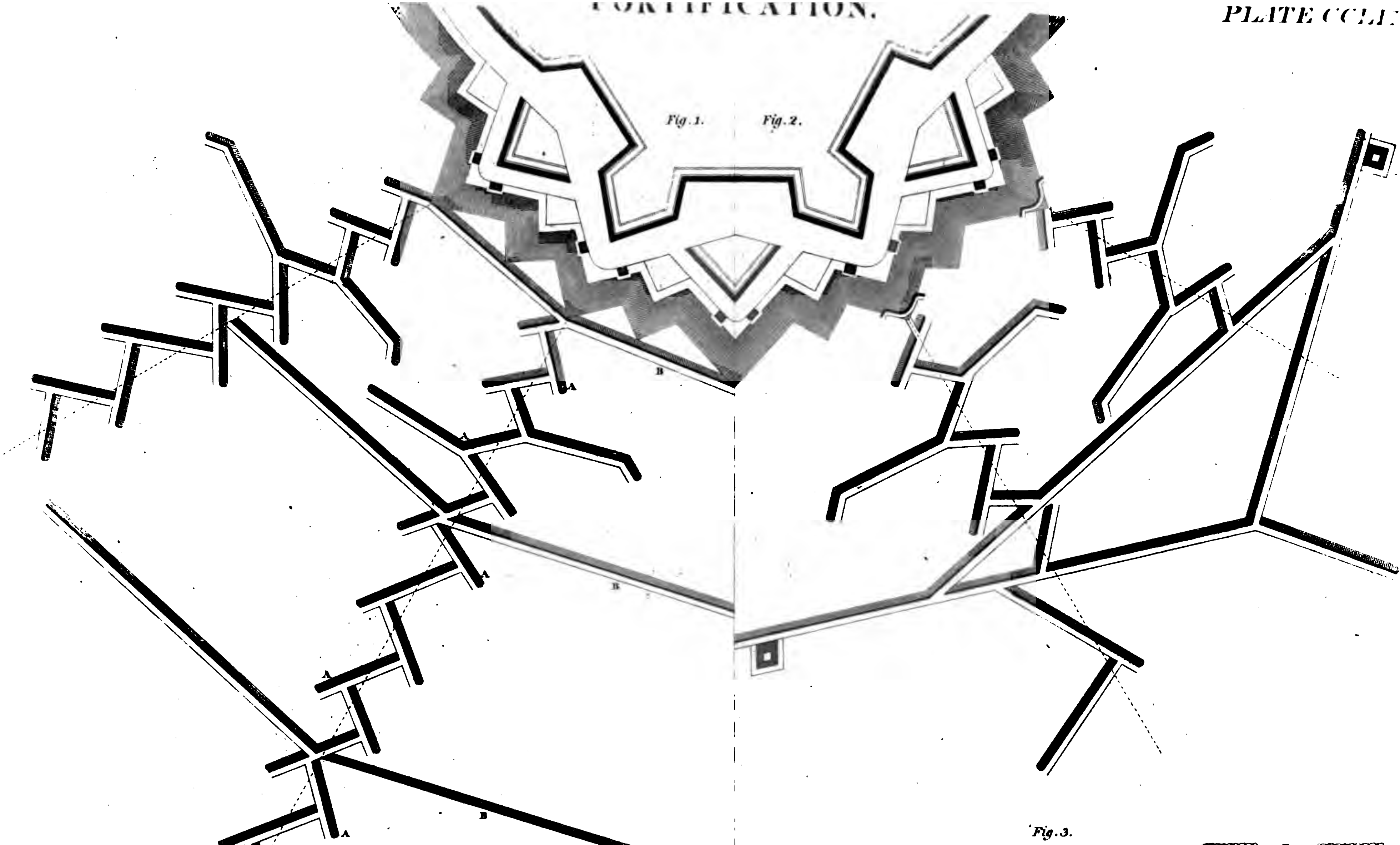

Fig. 1. Fig. 2.

Scale of Feet

Fig. 3.

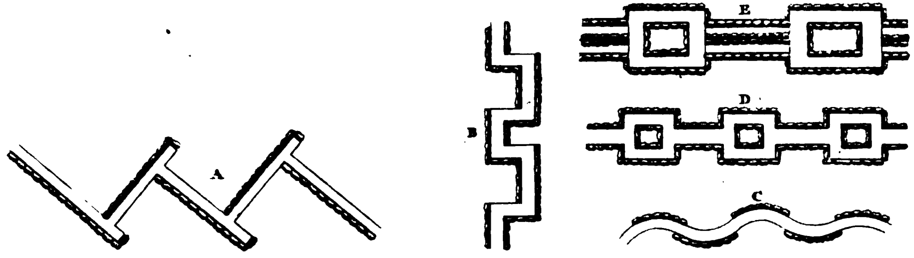

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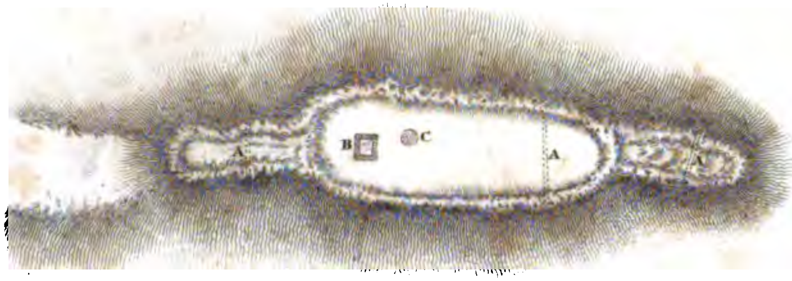
Fig.2.



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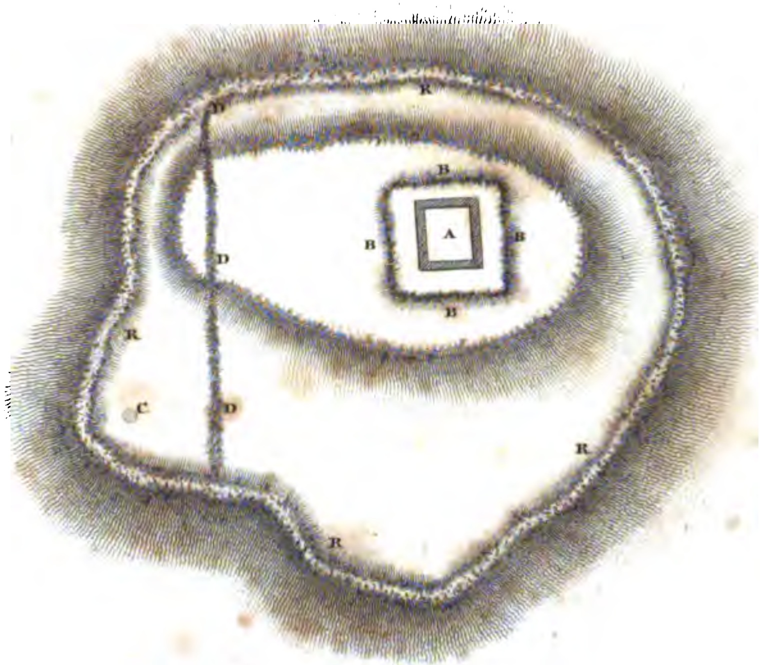

KNOCK FARRIL from the WEST.

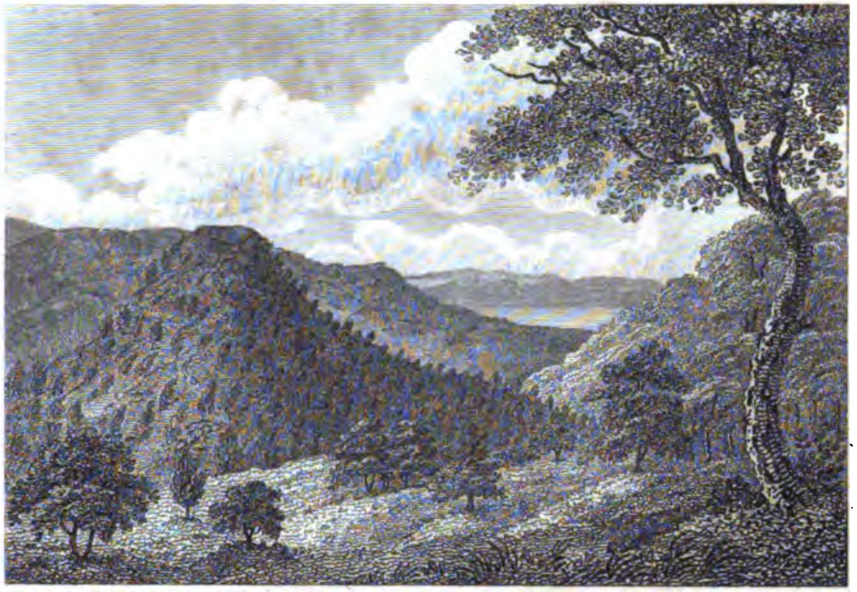

Fig.3.

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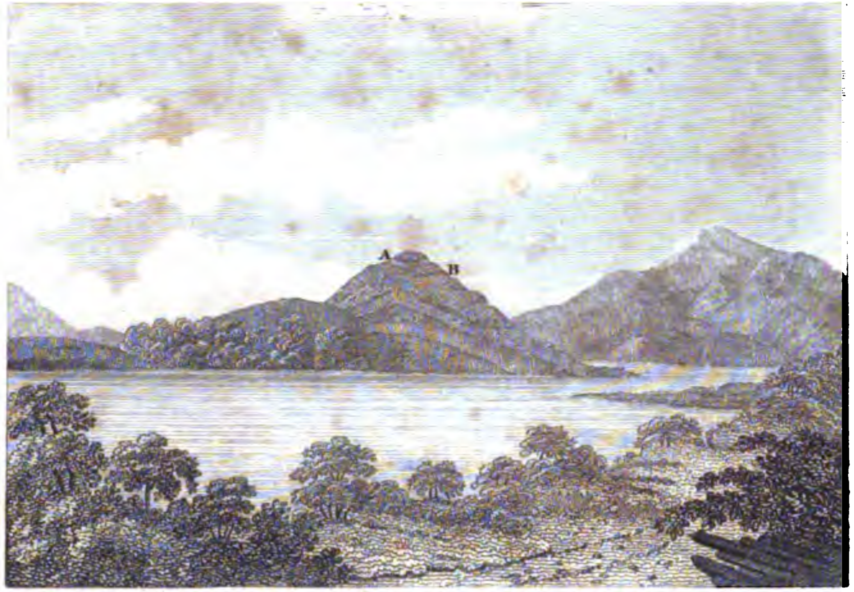

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